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A Revision of the Genus *Anthurium* (Araceae) of Mexico and Central America Part II: Panama

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This study was completed with support from the National Science Foundation (grant DEB 144-14, between 1970 and 1980). The revision of the Panamanian species, the most difficult of the North American species studied, has been ongoing since 1976. It was, however, with the initiation of the "Flora of Barro Colorado Island" project in 1967 that I discovered the taxonomic complexities inherent in this group and began doing serious field work. Difficulties in comprehending the variations exhibited in aroids and in making even preliminary determinations led me deeper into the morass, which has ultimately become my lifetime professional commitment. Almost from the beginning I realized the ease with which aroids could be cultivated and the immense value of studying them alive. The earliest live collections were made on Barro Colorado Island and studied at Summit Gardens. Later collections were made from elsewhere in Panama and most of these collections were sent to the Missouri Botanical Garden where living collections now total more than 4,000 individuals. In addition to my own live collections, plants from other collectors, principally employees of the Missouri Botanical Garden serving as Curator of Summit Herbarium, have been important. These include the collections of James Folsom, Barry Hammel, Thomas Antonio, and Kenneth Sytsma. In addition live material was collected by William G. D'Arcy and Robert Dressler. Their important help is gratefully acknowledged. Special thanks also goes to Haruyuki Kamemoto (University of Hawaii, Honolulu) whose collection of primarily Panamanian *Anthurium,* made during 1960 and housed at the University of Hawaii, is particularly important. One of the species collected by Kamemoto and Sagawa on Cerro Jefe has never been recollected. Kamemoto graciously allowed me to study his material in Honolulu and has sent me needed material as well. Appreciation goes to Yoneo Sagawa of the Lyon Arboretum and Gerry Carr of the University of Hawaii who gave the Missouri Botanical Garden vouchers of the above collections prepared by Richard Sheffer (Indiana University Northwest, Gary). Dr. Sheffer worked with Kamemoto's material while he was a student in Honolulu. Thanks goes to Dr. Sheffer himself whose five years of work with the Hawaiian collections gave him special insight into variation in many of the Panamanian species. He has generously contributed much advice. Special appreciation is also extended to Dan Nicolson (Smithsonian Institution, Washington, D.C.) who has kindly reviewed the manuscript and has given much advice concerning new Latin names. Finally, I wish to acknowledge the technical support of Frances Mazanec, Patricia Croat, Ann Ruger, Emily Finklang Colletti, and Petra Malesevich, without whose dedicated help the completion of this project would not have been possible.

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Abstract

Anthurium (Araceae), a distinct neotropical genus with more than 700 species, is a member of the subfamily Pothoideae. The genus ranges from northern Mexico and the Greater Antilles to southern Brazil and northern Argentina and Paraguay. Species diversity is greatest at lower to middle elevations of northern South America, Panama, and Costa Rica, while the upper and lower Amazonian forests are relatively poor in species. The first part of this paper (Mexico and Middle America) was published in the Annals of the Missouri Botanical Garden, Vol. 70: 211–420. 1983. In this second part 148 Panamanian species are treated. In the past six years a total of 102 taxa from Panama have been described as new to science. A total of 80 taxa are described as new to science in this paper, including 75 new species, two new subspecies, and three new varieties. The *Anthurium* flora of Panama exhibits considerable endemism with a total of 82 species (55%) being considered endemic. In addition, there is much local endemism within Panama with a number of areas exhibiting local endemism. The most well defined and localized of these include Cerro Jefe (Panamá Province), Cerro Sapo, and the Serranía de Pirre (Darién Province) but only three of the endemic Panamanian species are widespread within Panama, and 26 and 30 species, respectively, are restricted to areas to the west and east of the former Canal Zone. Other areas of local endemism include Chiriquí and Coclé Provinces.

Although most introductory remarks regarding *Anthurium* have been covered in Part I of this revision (Croat, 1983), certain points that concern only Panama will be discussed here. There are 153 taxa in Panama, of which 85 are currently considered endemic. Those species previously described in detail in Part I are given only abbreviated descriptions in this treatment.

History of Work with Panamanian *Anthurium*

In contrast to the situation with Costa Rican *Anthurium* (Croat & Baker, 1979; Croat, 1983) where many Costa Rican collections were intensively studied and described by both Schott (1858) and Engler (1905), both earlier workers with Araceae, relatively little was done in Panama preceding the present work. No Panamanian material was described as new by either Schott or Engler, which is surprising since together they described the largest share of all species included in Engler's (1905) revision of *Anthurium.* Following the publication of Engler's revision one of Engler's co-workers, Kurt Krause (1932) described four species of Panamanian *Anthurium,* and André Guillaumin (1925) described an additional species.

Paul Standley (1944), who wrote the Araceae treatment for the "Flora of Panama," described six species (three of them still in use) and with L. O. Williams (1952) described one additional species after the flora was published. In all, that work recognized only 32 species of *Anthurium,* which are still accepted. Ten additional Panamanian species were described by Croat and Baker (1979) in a revision of the *Anthurium* of Costa Rica and two years later I described nine additional species (Croat, 1981).

The 148 species currently recognized represent an increase of 462% over the number in the "Flora of Panama." While many of the species not included in Standley's revision have been collected since the Flora was published (indeed most since 1960), many currently recognized species were represented by specimens actually seen by Standley. This reflects the difficulty of working with herbarium specimens of Araceae since many of the important characters used to separate species are scarcely apparent on dried material. For example, Standley placed two good species into synonymy: *A. concolor* K. Krause with *A. hacumense* Engl. and *A. validifolium* K. Krause with *A. joseanum* Engl. (now *A. protensum* Schott). In other cases he used the wrong species names from other parts of Central America or South America for distinct Panamanian species. In many cases the species names he misapplied at that time have subsequently been correctly applied to material later collected in Panama.

Almost no critical work was done with the Araceae of Panama subsequent to the publication of the "Flora of Panama" until my interest developed in the late 1960s. This publication is the first in a series that will revise the Araceae of Panama.

Distribution of *Anthurium* in Panama

Panama represents the richest area for Araceae in North America. The species diversity of *Anthurium* that really begins in Costa Rica to the north, increases considerably as one moves southward to Panama and especially to Colombia. Costa Rica has over 80 of the total 219 species recognized for Mexico and Central America, but there are almost twice that many species in Panama. In addition, the discovery rate of new species

TABLE 1. Distribution of Panamanian *Anthurium*.

From Mexico		From Middle America		From Costa Rica		From Panama	
to Brazil	2	to Brazil, Peru, and Bolivia	3	to Colombia	11	to Venezuela	1
to West Indies and South America	1	to Venezuela	1	to Panama	23	to Colombia	11
to Panama	3	to Ecuador	5			Endemic	88
		to Colombia	2				
		to Panama	2				

in Panama is also much higher than in Costa Rica. I estimate that the present revision of Panamanian *Anthurium* represents a maximum of 95% of the species of *Anthurium* inhabiting the country. A number of suspected new species have already been collected but are inadequately known and are not included here. Relatively little of the Atlantic slope west of the Canal Zone has been investigated in detail, and little adequate botanizing has taken place in large sections of eastern Panama where species diversity is expected to be highest. As an example, a single expedition to one small area of the Serranía del Sapo near the Pacific coast turned up four unusual new species. Species richness in Panama is greatest at middle elevations along both sides of the Continental Divide and in the isolated mountain ranges in southeastern Darién near the Colombian border, notably the Serranía de Pirre and the Serranía del Sapo. Although the mountains in the Azuero Peninsula show considerable amounts of tropical wet and premontane rain forest (known to be the life zones of greatest species diversity in *Anthurium*), the dry season there is too severe to support many epiphytes. Natives of the region report that it generally does not rain at all during the dry season. During an expedition there, a six hour walk from Jobero (Los Santos Province) to the headwaters of the Río Pedregal yielded few aroids. A comparable trek through similar parts of the Continental Divide would have yielded scores of species of *Anthurium*.

Although little of the Serranía de Cañasas has yet been investigated, it also appears to be less rich in species than the Continental Divide. While little is known of the rainfall in this area, it also lies to some extent in the rain shadow of the Continental Divide, which may create situations of prolonged drought in the dry season from December to May.

As a means of evaluating the phytogeographic characteristics of *Anthurium* in Panama, a study was made to determine the geographical affinities of the Panamanian *Anthurium* flora with that of adjacent areas and to determine areas of local endemism that occur within Panama. The results are summarized in Table 1.

Perhaps the most striking feature of the distribution of *Anthurium* is the restricted geographical range of most species. For example, only two taxa are truly Pan-American in their distribution, namely *A. gracile* (Rudge) Lindl. and *A. scandens* (Aubl.) Engl. ssp. *scandens*, ranging from Mexico to Brazil. Nine additional taxa range less widely but extend from Middle America (Guatemala to Costa Rica) to at least northern South America (excluding Colombia). These are *A. clavigerum* Poepp., *A. cuspidatum* Mast., *A. interruptum* Sodiro, *A. kunthii* Poepp., *A. ravenii* Croat & Baker, *A. scandens* ssp. *pusillum* Sheffer, *A. trinerve* Miq., *A. trisectum* Sodiro, and *A. williamsii* K. Krause. One species, *A. cubense* Engl., has a circum-Caribbean distribution occurring in Cuba, Central America, and northern South America. Surprisingly few species are strictly Central American. Aside from the 26 species shared by Panama and Costa Rica, only five Panamanian species range further north: *A. acutangulum* Engl. (to Honduras), *A. ramonense* Engl. ex K. Krause (to Guatemala), *A. flexile* Schott, *A. salviniae* Hemsl., and *A. pentaphyllum* var. *bombacifolium* (Schott) Madison (to Mexico). Only two additional species, *A. bakeri* Hook. f. and *A. friedrichsthalii* Schott, are principally Central American, ranging from Guatemala to Colombia. The 26 species shared by Costa Rica and Panama are *A. acutangulum* Engl., *A. acutifolium* Engl., *A. angustispadix* Croat & Baker, *A. caperatum* Croat & Baker, *A. carnosum* Croat & Baker, *A. concinnatum* Schott, *A. consobrinum* Schott, *A. cotobrusii* Croat & Baker, *A. cuneatissimum* (Engl.) Croat, *A. davidsoniae* Standl., *A. fatoense* K. Krause, *A. hacumense* Engl., *A. hoffmannii* Schott, *A. ochranthum* C. Koch, *A. pallens* Schott, *A. pittieri* Engl., *A. pluricostatum*

Croat & Baker, *A. purpureospathum* Croat, *A. ranchoanum* Engl., *A. seibertii* Croat & Baker, *A. spathiphyllum* N. E. Brown, *A. standleyi* Croat & Baker, *A. tilaranense* Standl., *A. tonduzii* Engl., *A. validifolium* K. Krause, and *A. wendlingeri* G. M. Barroso.

The Pacific coast *Anthurium* flora of both Colombia and Ecuador is considerably related to species from both Panama and Costa Rica, and this affinity is likely to be bolstered as more intensive collecting occurs, especially in the Department of Chocó in northern Colombia. There are ten species that range from Costa Rica to Colombia, namely *A. brownii* Mast., *A. formosum* Schott, *A. lancifolium* Schott, *A. lentii* Croat & Baker, *A. michelii* Guillaumin, *A. microspadix* Schott, *A. obtusilobum* Schott, *A. paludosum* Engl., *A. panduriforme* Schott, and *A. watermaliense* Hort. ex L. H. Bailey. Eleven additional species are already known from Panama to Colombia, namely *A. alticola* Croat, *A. cineraceum* Croat, *A. concolor* K. Krause, *A. crystallinum,* Linden & André, *A. dressleri* Croat, *A. erythrostachyum* Croat, *A. fragrantissimum* Croat, *A. garagaranum* Standl., *A. malianum* Croat, *A. myosuroides* (H.B.K.) Endl., and *A. vallense* Croat. One species, *A. fendleri* Schott, ranges from Panama to Colombia and Venezuela.

Of the 148 species of *Anthurium* in Panama, 82 (or 55%) are now considered endemic. This is very high compared with the average rate of endemism for other taxa in Panama. For example, only 7% of all species in the "Flora of Barro Colorado Island" (Croat, 1978) were endemic to Panama. The figure was somewhat higher (12%) for epiphytic herbs even though this group also contained many species of ferns with easily dispersed wind borne spores. Fruits of *Anthurium* are much less likely to be widely dispersed. Most *Anthurium* species occur in the understory of dense forests and their fleshy, colorful fruits are ideally suited for bird dispersal. Moreover, the majority of species are probably dispersed by forest dwelling birds rather than by migratory birds or birds living in clearings or along forest margins. Forest bird species are much more likely to be territorial or otherwise restricted in their movements. This may help to explain why there are so many apparent local endemic species of *Anthurium. Anthurium* appears to have an even higher rate of endemism than the other genera of Araceae. For example in *Syngonium* (Croat, 1982) only two of the 13 Panamanian species (ca. 15%) are endemic, and in *Monstera* (Madison, 1977) only one of the 12 Panamanian species is endemic (ca. 8% of the genus).

Perhaps even more surprising than the high rate of endemism in Panama is the fact that there seem to be several areas of endemism even within Panama (Table 2). Not surprisingly most of these areas are associated with hilltops, but other apparent areas of endemism are not strongly related to mountaintop isolation.

Of the 82 species endemic to Panama, 26 are restricted to western Panama (i.e., west of the former Canal Zone) and 30 are restricted to the area east of the Canal Zone. Only three of the endemic species are found to be relatively widespread (or at least occurring in both Chiriquí and in Darién Provinces). These are *A. hutchisonii* Croat, *A. sanctifidense* Croat, and *A. antonioanum* Croat. Three additional species are known from central Panama only and occur on both sides of the Canal Zone: *A. cerrocampanense* Croat, *A. melastomatis* Croat, and *A. roseospadix* Croat. Five species range from Veraguas to Darién, namely *A. bicollectivum* Croat, *A. colonense* Croat, *A. cucullispathum* Croat, *A. curvispadix* Croat, and *A. luteynii* Croat. One species, *A. papillilaminum* Croat, ranges from Colón (west of the Canal Zone) to Darién.

Of the western Panama endemics, 14 taxa are restricted to Chiriquí Province, which has higher average elevation than the rest of western Panama. Most have been discovered in forest along the Continental Divide such as on Cerro Colorado or on the Pacific slope along the Fortuna Dam Road. The Chiriquí endemics include *A. chiriquense* Standl., *A. circinatum* Croat, *A. coloradense* Croat, *A. fusiforme* Croat, *A. globosum* Croat, *A. gracililaminum* Croat, *A. gracilispadix* Croat, *A. lancifolium* var. *albifructum* Croat, *A. longistipitatum* Croat, *A. madisonianum* Croat, *A. pauciflorum* Croat, *A. protensum* ssp. *arcuatum* Croat, *A. pseudospectabile* Croat, and *A. validifolium* K. Krause. Almost no exploration for *Anthurium* has taken place on the much wetter Caribbean slopes though three taxa are newly described here from the Atlantic slope in Bocas del Toro Province. These are *A. hammelii* Croat, *A. teribense* Croat, and *A. wedelianum* Croat ssp. *wedelianum.*

None of the species from Chiriquí, nor any of those from Veraguas or Coclé to be mentioned next, would appear to be particularly isolated on mountaintops, and the Chiriquí region is connected to Veraguas and Coclé by a continuous belt of forest along the Continental Divide. Yet

TABLE 2. Distribution of *Anthurium* within Panama.

From Chiriquí		From Veraguas		From Coclé		From Colón		From Panamá		From Darién	
to Darién	3	to Darién	5	to Darién	1	to Darién	2	to San Blas	1	Endemic	16
to Veraguas	1	to Panamá		to San Blas	1	to San Blas		Endemic	12	(Serranía de Pirre	8)
to Coclé	3	and Colón	3	to Colón	1	and Panamá	2	(Cerro Jefe	8)	(Serranía del Sapo	3)
to Bocas del		to Coclé	4	to Panamá	1	Endemic	1	(Cañasas	3)	(Cerro Tacarcuna	4)
Toro	3	Endemic	2	Endemic	6			(elsewhere	1)	(elsewhere	1)
Endemic	14										

despite the relatively close proximity of the rich Chiriquí sites mentioned (e.g., Cerro Colorado and the Fortuna Dam area), only two species, *A. horniitense* Croat and *A. tutense* Croat are common to these provinces. How much this is related to real differences and how much to collecting deficiencies is not known.

Three species, *A. caloveboranum* Croat, *A. dichrophyllum* Croat, and *A. kalhunkiae* Croat, are restricted to Veraguas Province (most having been collected on Cerro Tute or along the trail from Santa Fe to Calovébora), and seven taxa, *A. brevispadix* Croat, *A. crassilaminum* Croat, *A. crassiradix* var. *purpureospadix* Croat, *A. curvilaminum* Croat, *A. hebetatum* Croat, *A. oxystachyum* Croat, and *A. sytsmae* Croat are restricted to Coclé (mostly collected along the Continental Divide north of El Copé). Three additional taxa are shared by the two provinces: *A. panamense* Croat, *A. rupicola* Croat, and *A. weddelianum* ssp. *viridispadix* Croat. The assumed endemic localities in Veraguas and Coclé are likely to represent artifacts of collecting, as the areas between the two provinces have not been well collected. Nevertheless, some areas such as the El Valle vicinity further east in Coclé Province have been botanized for many years and have not turned up many of the species now known from El Copé. El Valle is about the same distance from El Copé as the latter is from Santa Fe.

In the eastern half of Panama there are four apparent centers of local endemism, namely the Cerro Jefe region, the Serranía de Cañasas, the Serranía de Pirre, and the Serranía del Sapo. Only the first has been well collected, and it is perhaps the most surprising area of endemism as it is not really much isolated from the nearby collecting areas of the El Llano-Cartí Road to the east and the Santa Rita Ridge Road to the northeast. Despite the fact that these three areas have many species in common there are still eight very distinct species that have been collected only on Cerro Jefe and in the immediate nearby regions. This is the most startling case of endemism I have encountered in *Anthurium*. The species found only in the vicinity of Cerro Jefe are *A. cinereopetiolatum* Croat, *A. folsomianum* Croat, *A. genryi* Croat, *A. jefense* Croat, *A. kamemotoanum* Croat, *A. sagawae* Croat, *A. supraglandulum* Croat, and *A. tysonii* Croat.

The El Llano-Cartí Road and the Santa Rita Ridge Road, both excellent collecting areas over the past decade, have turned up numerous interesting collections, sometimes shared with Cer-

ro Jefe (*A. crassiradix* Croat) and, at least in the case of *A. cerrocampanense* Croat, also with Cerro Campana on the other side of the Canal Zone. Nevertheless these two roads share two species not known elsewhere: *A. cartiense* Croat and *A. correae* Croat. Another species, *A. angustilobum* Croat, is known only from the El Llano-Cartí Road. Two other species from the El Llano-Cartí Road have been collected considerably to the east on the Continental Divide in the Cordillera de San Blas at Cerro Habú, and it is expected that with better collecting in eastern Panama many of the species now restricted to central Panama will be found throughout the Central Cordillera.

The Serranía de Cañasas, an isolated mountain range in southern Panamá Province, remains largely unexplored, but I suspect it will prove to be relatively poor in species. This assumption could be wrong as it is based on studies made only of the lower slopes. The recent completion of the Pan-American Highway to Darién Province provides access to the northeast corner of the Serranía de Cañasas and the relatively few collections from the area above Tortí Arriba have already turned up three endemic species; other collections may prove to represent new species as well.

Relatively few species restricted to the eastern half of Panama occur both in the Canal Zone vicinity and also in Darién. Two species that are known to have this distribution are *A. impolitum* Croat and *A. pendens* Croat, although the latter may occur in Colombia.

Unlike the Cerro Jefe, El Llano-Cartí, and Santa Rita Ridge areas, the mountain chains of southeastern Darién Province are isolated both from each other to some extent and certainly from the Central Cordillera. On my first visit there, after having collected extensively throughout much of the Central Cordillera, I was surprised to see no species I recognized. No less than seven species have proven to be endemic, namely *A. cerropirrense* Croat, *A. crassitepalum* Croat, *A. niqueanum* Croat, *A. pirrense* Croat, *A. rubrifructum* Croat, *A. subrotundum* Croat, and *A. terryae* Standl. & L. O. Wms.

The Serranía del Sapo, lying along the Pacific Ocean southwest of the Pirre chain, has scarcely been sampled. However, in two trips there Barry Hammel has collected three endemic species: *A. barryi* Croat, *A. chromostachyum* Croat, and *A. sapense* Croat; in addition, one species, *A. redolens* Croat, is known from the Serranía del Sapo and Serranía Cañasas.

Darién Province has four additional endemic species that are not restricted to these two mountain chains. These are *A. dukei* Croat and *A. rotundistigmatum* Croat (both at least partially from lower elevations), *A. tacarcunense* Croat (from Cerro Tacarcuna in the Serranía del Darién, the end of the Central Cordillera that extends into Colombia), and *A. foreroanum* Croat (known from both Cerro Tacarcuna and Cerro Pirre).

Further field work on the Pirre and Sapo chains, both of which extend briefly into Colombia, will undoubtedly show that many of the species found occurring on them occur in Colombia as well. Nevertheless, it is unlikely that these species will prove to be widespread in lowland parts of the Chocó Department.

PROVISIONAL SECTIONAL PLACEMENT OF *ANTHURIUM* SPECIES OF PANAMA[1]

1a. Leaf blades prominently 3-lobed or palmatifid to palmatisect.
  2a. Leaf blades with 3 lobes, united at the base; the lateral or posterior lobes often smaller than the median lobe. ..... Section *Semaeophyllium* Schott
    A. angustilobum Croat
    A. cineraceum Croat
    A. garagaranum Standl.
    A. impolitum Croat
    A. madisonianum Croat
    A. tilaranense Standl.
  2b. Leaf blades with 3 or more lobes, free to the base. ..... Section *Dactylophyllium* Schott
    A. clavigerum Poepp.
    A. kunthii Poepp.

[1] Two sections do not occur in Panama. Section *Gymnopodium* is represented by a single Cuban species, *A. gymnopus* Grisebach. Section *Chamaerepium* is represented by a single Brazilian species, *A. radicans* C. Koch. Although Section *Urospadix* may be restricted to South America, with concentrations in eastern and southeastern Brazil, some Panamanian species are tentatively placed in this section. Characters in key may be broader than those for the species represented.

A. pentaphyllum (Aubl.) G. Don var. *bombacifolium* (Schott) Madison
A. trisectum Sodiro

1b. Leaf blades entire or nearly so, sometimes with the anterior lobe markedly constricted at the base but never distinctly 3-lobed.

3a. Leaf blades conspicuously dark glandular-punctate at least on the lower surface.

4a. Leaf blades cordate, hastate or otherwise with usually definite posterior lobes; most basal veins usually merging with the margin of the blade before the middle of the blade. ..... Section *Belolonchium* Schott (*A. verapazense* alliance)
A. hornitense Croat

4b. Leaf blades acute to obtuse or subcordate at base with usually only a single collective vein extending along the margin to the apex (sections *Tetraspermium* and *Porphyrochitonium*) or with several basal veins prominently arcuate-ascending to the apex with many close, parallel primary lateral veins giving the blade the appearance of a melastomataceous leaf blade (section *Digitinervium*).

5a. Leaf blades with several pairs of basal veins sharply arcuate-ascending, extending to or almost to the apex; primary lateral veins numerous, distinct, parallel, and extending more or less straight between all the basal veins giving the leaf blade the appearance of a melastomataceous blade; number of ovules and seeds per locule unknown. ..... Section *Digitinervium* Sodiro
A. lentii Croat & Baker

5b. Leaf blades with usually no more than one pair of basal veins (usually merely the collective vein) extending along the margin to the apex; primary lateral veins usually not numerous or closely parallel; ovules and seeds usually 2 or more per locule.

6a. Plants mostly scandent; stems slender, mostly less than 6 mm diam.; internodes somewhat elongate; berries acute at apex. ..... Section *Tetraspermium* Schott
A. scandens (Aubl.) Engl. ssp. *scandens*
A. scandens ssp. *pusillum* Sheffer
A. tonduzii Engl.
A. trinerve Miq.

6b. Plants usually more or less caespitose, at least lacking slender, scandent stems; stems usually more than 1 cm diam.; berries often more or less truncate and indented at the apex. ..... Section *Porphyrochitonium* Schott
A. acutangulum Engl.
A. alticola Croat
A. amnicola Dressler
A. bakeri Hook. f.
A. barryi Croat
A. bicollectivum Croat
A. brevispadix Croat
A. caloveboranum Croat
A. cartiense Croat
A. chiriquense Standl.
A. circinatum Croat
A. collinsii Croat
A. crassilaminum Croat
A. crassiradix Croat var. *crassiradix*
A. crassiradix var. *purpureospadix* Croat
A. crassitepalum Croat
A. cuasicanum Croat
A. curvilaminum Croat
A. dichrophyllum Croat
A. dwyeri Croat
A. fragrantissimum Croat
A. friedrichsthalii Schott
A. gentryi Croat
A. gracililaminum Croat
A. gracilispadix Croat
A. hacumense Engl.
A. jefense Croat
A. kallunkiae Croat
A. lactifructum Croat
A. lancifolium Schott var. *lancifolium*
A. lancifolium var. *albifructum* Croat
A. longistipitatum Croat
A. melastomatis Croat

A. oxystachyum Croat
A. pageanum Croat
A. paludosum Engl.
A. pendens Croat
A. pirrense Croat
A. ramonense Engl. ex K. Krause
A. redolens Croat
A. rupicola Croat
A. sagawae Croat
A. subrotundum Croat
A. supraglandulum Croat
A. sytsmae Croat
A. tacarcunense Croat
A. terryae Standl. & L. O. Wms.
A. tutense Croat
A. vallense Croat
A. wendlingeri G. M. Barroso

3b. Leaf blades epunctate or at least not conspicuously dark glandular-punctate.

7a. Vernation of leaf blades involute (i.e., with both margins rolled inward toward the midrib in bud); plants frequently with a "bird's nest" habit (i.e., short stems and rosulate leaves); blades often thick, frequently more or less oblanceolate or obovate to elliptic; the primary lateral veins (at least the lower ones) joining the margins. _____ Section *Pachyneurium* Schott

A. acutifolium Engl.
A. colonicum K. Krause
A. concolor K. Krause
A. consobrinum Schott
A. cubense Engl.
A. cuneatissimum (Engl.) Croat
A. cuspidatum Mast.
A. fatoense K. Krause
A. fendleri Schott
A. luteynii Croat
A. nervatum Croat
A. protensum Schott ssp. *arcuatum* Croat
A. pseudospectabile Croat
A. purpureospathum Croat
A. ranchoanum Engl.
A. salviniae Hemsl.
A. seibertii Croat & Baker
A. spathiphyllum N. E. Brown
A. standleyi Croat & Baker
A. validifolium K. Krause

7b. Vernation of leaf blades supervolute (i.e., with one margin rolled inward toward the midrib but with the alternate margin rolled around the midrib and the rolled up opposite margin, giving the "cross-sectional" view a cochleate appearance); plants usually lacking a "bird's nest" habit; leaves various; the primary lateral veins frequently joining into a collective vein before reaching the margin.

8a. Stems scandent and wiry; internodes elongate, usually less than 3 mm thick, with numerous, short adventitious roots scattered along their length; flowering branches bearing 1–6 leaves; 1-ribbed cataphylls lacking; pollen inaperturate, gemmate. _____ Section *Polyphyllium* Engl.

A. flexile Schott

8b. Stems short or scandent but not slender and wiry; internodes short or long but not slender and wiry, usually more than 8 mm diam., the adventitious roots restricted to the nodes; flowering branches bearing a single leaf (branches are short and do not appear like branches); 1-ribbed cataphylls present and usually conspicuous; pollen forate, reticulate to spinulose.

9a. Roots white, bearing a velamen; blades thin, narrowly oblanceolate, the primary lateral veins numerous and scarcely more prominent than the interprimary veins, stems rarely more than 1 cm diam. with persistent reddish brown, intact cataphylls; spadix with no more than 3 flowers visible per spiral (from any angle); chromosome numbers $2n = 40$ or 60. _____ Section *Leptanthurium* Schott

A. gracile (Rudge) Lindl.

9b. Roots usually greenish, lacking velamen; blades various, usually with the primary lateral veins conspicuously more prominent than the interprimary veins; stems various; cataphylls usually weathering (except section *Calomystrium* with cordate blades);

number of flowers visible per spiral various but usually more than 3 per spiral; chromosome numbers mostly $2n = 30$.

10a. Leaf blades velvety, usually metallic green or blackish green in color; the epidermal cells papillate or otherwise elevated; petioles frequently ribbed; B-chromosomes present. ..... Section *Cardiolonchium* Schott

A. cerrocampanense Croat
A. crystallinum Linden & André
A. dressleri Croat
A. folsomianum Croat
A. papillilaminum Croat

10b. Leaf blades not velvety, usually smooth and semiglossy to glossy; the epidermal cells flat, not papillate or raised; petioles various but not commonly ribbed; B-chromosomes lacking.

11a. Stems bearing conspicuous, thick, intact, persistent, reddish brown cataphylls; leaf blades usually thick; the minor veins usually not prominently raised; the upper blade surface usually with linear raphide cells visible; spadix often colored and often sweetly scented; spathe usually thick, often broad. ..... Section *Calomystrium* Schott

A. chromostachyum Croat
A. colonense Croat
A. cucullispathum Croat
A. curvispadix Croat
A. erythrostachyum Croat
A. foreroanum Croat
A. formosum Schott
A. fusiforme Croat
A. globosum Croat
A. hammelii Croat
A. hoffmannii Schott
A. kamemotoanum Croat
A. obtusilobum Schott
A. ravenii Croat & Baker
A. roseospadix Croat
A. sanctifidense Croat
A. sapense Croat
A. tysonii Croat

11b. Stems usually with cataphylls deciduous or weathering into a mass of fibers; leaf blades thick or thin; the minor veins conspicuous or not; the upper surface usually lacking raphide cells; spadix various, less frequently scented; spathe various, often lanceolate.

12a. Leaf blades much longer than broad, oblong to linear (rarely ovate but then thin, veiny, and weakly bullate in *A. davidsoniae*).

13a. Stems elongate, erect to scandent, 7–20 mm diam.; berries frequently green. ..... Section *Xialophyllium* Schott

A. angustispadix Croat & Baker
A. carnosum Croat & Baker
A. cerropirrense Croat
A. coclense Croat
A. davidsoniae Standl.
A. hutchisonii Croat
A. interruptum Sodiro
A. leptocaule Croat
A. microspadix Schott
A. myosuroides (H.B.K.) Endl.
A. pallens Schott
A. pauciflorum Croat
A. rubrifructum Croat
A. testaceum Croat & Baker

13b. Stems short; the internodes short; stems mostly less than 10 mm diam.; berries usually not green (except in *A. caperatum* and *A. panduriforme*).

14a. Flowers with pistils early emergent, usually held considerably above the tepals at anthesis; spathe conspicuously decurrent. ..... Section *Oxycarpium* Schott[2]

[2] This section only tentatively used and further work may prove it to be unwarranted.

A. pittieri Engl. var. *pittieri*
A. pittieri var. *morii* Croat

14b. Flowers with pistil scarcely or not at all emergent at anthesis; spathe usually not decurrent (except in *A. correae*). ..... Section *Urospadix* Engl.

A. correae Croat
A. llanense Croat
A. michelii Guillaumin
A. platyrhizum Croat
A. wedelianum Croat ssp. *wedelianum*
A. wedelianum ssp. *viridispadix* Croat

12b. Leaf blades not much longer than broad (or at least not oblong or linear), mostly more or less ovate with posterior lobes.

15a. Blades moderately thin, often conspicuously veiny or even bullate; anterior lobe usually with numerous, close, more or less parallel veins. ..... Section *Polyneurium* Engl.

A. caperatum Croat & Baker
A. chorranum Croat
A. coloradense Croat
A. malianum Croat
A. niqueanum Croat
A. panduriforme Schott
A. williamsii K. Krause

15b. Blades coriaceous or nearly so, usually smooth and not noticeably veiny or bullate; anterior lobe lacking numerous close parallel veins. ..... Section *Belolonchium* Schott

A. antonioanum Croat
A. brownii Mast.
A. cinereopetiolatum Croat
A. concinnatum Schott
A. cotobrusii Croat & Baker
A. dukei Croat
A. hebetatum Croat
A. ochranthum C. Koch
A. panamense Croat
A. pluricostatum Croat & Baker
A. rotundistigmatum Croat
A. teribense Croat
A. watermaliense Hort. ex L. H. Bailey

KEY TO *ANTHURIUM* OF PANAMA

1a. Leaves palmately divided to the base, usually more than 3-lobed. ..... KEY A
1b. Leaves simple, sometimes 3-lobed (but not to the base).
2a. Leaf blades 3-lobed, the margins constricted near the base of the anterior lobe. ..... KEY B
2b. Leaf blades not 3-lobed.
3a. Leaves dark glandular-punctate on one or both surfaces. ..... KEY C
3b. Leaves not dark glandular-punctate on either surface.
4a. Leaf blades cordate or subcordate at base with prominent posterior lobes. ..... KEY D
4b. Leaf blades not cordate or subcordate at base. ..... KEY E

KEY A

Leaves palmately divided to the base, usually more than 3-lobed.

1a. Leaves 3-foliolate with the segments free to the base; plants terrestrial. ..... *A. trisectum* Sodiro
1b. Leaves 5–13-foliolate or lobed; plants epiphytic climbers.
2a. Huge scandent epiphyte; leaflets lobed; peduncle elongate; spadix to 75 cm long; spathe dark violet purple. ..... *A. clavigerum* Poepp.
2b. Relatively small, scandent plants with long internodes; leaflets not lobed (except the basal leaflet); peduncle long or short; spadix less than 25 cm long; spathe green to purplish.
3a. Leaf segments all more or less equal, petiolules 4–6 cm long; peduncles slender and long, usually more than 20 cm long, longer than spadix; spadix whitish to greenish at anthesis. ..... *A. kunthii* Poepp.
3b. Leaf segments unequal, the lowermost more or less auriculate and usually markedly inequilateral; petiolules usually short, less than 2 cm long with the leaf tissue decurrent often almost to the base; peduncles short and stout, usually less than 6 cm long and shorter than the spadix;

spadix lavender at anthesis. ..... *A. pentaphyllum* (Aubl.) G. Don var. *bombacifolium* (Schott) Madison.

KEY B

Leaves simple, sometimes 3-lobed (but not to the base); the margins constricted near the base of the anterior lobe.

1a. Posterior lobes of the blade usually reflexed or spreading laterally at 90° angle.
  2a. Posterior lobes usually markedly curved backward at the base, directed slightly inward, generally not broader toward the apex; blades coriaceous, the margins markedly undulate. ..... *A. brownii* Mast.
  2b. Posterior lobes usually not curved backward and inward at the base, generally broader toward the apex; blades thin to coriaceous, the margins straight or nearly so, not markedly undulate.
    3a. Blades drying yellow-green, comparatively thin, the dried lower surface markedly glossy; posterior rib naked only near the base; the basal veins then fanning out in both directions from the posterior rib; berries pale green. ..... *A. panduriforme* Schott
    3b. Blades drying brownish, comparatively coriaceous to subcoriaceous; the dried lower surface matte; posterior rib naked throughout most of its length, continuous along the edge of the blade with the posterior ribs all directed away from the lower edge; berries red. ..... *A. angustilobum* Croat
1b. Posterior lobes of blades usually arched prominently toward the apex.
  4a. Plants terrestrial, well-rooted, the lower blade surface matte; spadix green. ..... *A. impolitum* Croat
  4b. Plants epiphytic; the lower blade surfaces semiglossy to glossy (at least on live plants); spadix white, yellow, or reddish (rarely green just before anthesis on *A. tilaranense*).
    5a. Cataphylls persisting intact; spadix greenish white to white, less than 10 cm long. ..... *A. tilaranense* Standl.
    5b. Cataphylls weathering to persistent coarse fibers; spadix greenish, yellow, or reddish violet, more than 13 cm long.
      6a. Spadix bright yellow; posterior lobes of larger leaves usually broadly rounded at apex, usually less than 2 times longer than broad; usually less than 700 m, Coclé, Colón, and Panamá Provinces. ..... *A. garagaranum* Standl.
      6b. Spadix green or reddish violet to magenta; posterior lobes narrowly rounded to bluntly acute, usually more than 2.5 times longer than broad.
        7a. Spadix reddish violet to magenta; western Panama. ..... *A. madisonianum* Croat
        7b. Spadix greenish; eastern Panama. ..... *A. cineraceum* Croat

KEY C

Leaf blades not 3-lobed; dark glandular-punctate on one or both surfaces.

1a. Plants slender, scandent with long stems, often hanging from trees; berries translucent white, pale violet, or purple; blades usually much less than 14 cm long.
  2a. Internodes 2–21 cm long, not clothed in persistent cataphylls; leaf blades usually rounded at base; primary lateral veins usually 3–6 per side. ..... *A. tonduzii* Engl.
  2b. Internodes usually less than 2 cm long, rarely more than 4 cm long, at least the younger stems clothed in persistent, weathering cataphylls; leaf blades usually obtuse to acute at base; primary lateral veins usually numerous.
    3a. Flowering spadix purplish, the pistil whitish, noticeably quadrangular, emerging prominently before stamens emerge; spathe persistently erect and more or less parallel to the spadix; berries broadly ovate to obovate, usually acute to apiculate at apex; sea level to 800 m. ..... *A. trinerve* Miq.
    3b. Flowering spadix greenish, the pistil greenish, round to weakly quadrangular, emerging only after the stamens have emerged; spathe strongly reflexed soon after opening; berries depressed-globose to globose, rounded to flat at apex; sea level to 2,700 m.
      4a. Spadix 16–60-flowered, 7–30 mm long at anthesis; blade punctate or not on upper surface, 4–16 cm long. ..... *A. scandens* (Aubl.) Engl. ssp. *scandens*
      4b. Spadix 5–12(–16)-flowered, 2–10 mm long at anthesis; blade punctate on upper surface, 2–7.5 cm long. ..... *A. scandens* ssp. *pusillum* Sheffer
1b. Plants usually not at all scandent, mostly with short internodes (moderately long in *A. collinsii, A. subrotundum,* and *A. melastomatis* but with stems erect, mostly terrestrial); berries various; leaves often more than 14 cm long.
  5a. Blades more than 15 cm wide and cordate or subcordate at base.
    6a. Blades ovate to broadly ovate; the lobes rounded; most basal veins extending to the apex quite removed from the margin. ..... *A. lentii* Croat & Baker
    6b. Blades ovate-triangular; the lobes usually longer than broad; the uppermost basal vein extending to the apex very near the margin. ..... *A. hornitense* Croat

5b. Blades either less than 15 cm wide or not at all subcordate to cordate at base.
7a. Most petioles less than one-third as long as blades.
8a. Leaf blades more than 5 times longer than broad.
9a. Plants erect, the blades erect-spreading, not at all pendent; collective veins prominently sunken on the upper surface.
10a. Blades with the collective veins much more prominently sunken than the primary lateral veins; primary lateral veins scarcely raised on the lower surface; spadix whitish. ——— *A. bakeri* Hook. f.
10b. Blades with the collective vein sunken about equally as the primary lateral veins; primary lateral veins prominently raised on the lower surface. ——— *A. redolens* Croat
9b. Plants pendent, the blades dangling usually straight downward from the stem; the collective veins not at all sunken on upper surface.
11a. The largest blades usually less than 3 cm rarely to 4 cm wide, generally less than 50 cm long; berries broader than long (also broader in direction of the axis of spadix). ——— *A. friedrichsthalii* Schott
11b. The largest blades on mature plants more than 4 cm wide, generally more than 50 cm long; berries as long as broad or longer than broad (not broader in direction of the axis of spadix).
12a. Blades oblong-linear, broadest near the middle or below the middle, drying green to yellow-green; the primary veins arising at a 20–40° angle from the midrib; spadix white to grayish white at anthesis, 12–80 cm long, soon coiled into a helicoid spiral; berries reddish, obovoid, weakly beaked at apex, terete in cross-section. ——— *A. wendlingeri* G. M. Barroso
12b. Blades narrowly oblanceolate, broadest above the middle, drying conspicuously blackened; the primary lateral veins arising at a 10–20° angle from the midrib; spadix greenish purple or purplish brown at anthesis, 3–15 cm long, not coiled; berries orange. ——— *A. pendens* Croat
8b. Leaf blades less than 5 times longer than wide.
13a. Spadix purplish; collective vein usually to 2 cm from the margin.
14a. Large rosulate epiphyte; stipe elongating to 18 cm; petiole ca. one-tenth as long as blades; primary lateral veins prominently curved. ——— *A. hacumense* Engl.
14b. Leaves not conspicuously rosulate; stipe less than 1 cm long; petiole one-fourth to one-third as long as blade; primary lateral veins straight. ——— *A. curvilaminum* Croat
13b. Spadix not purplish, either green, yellow, or white; collective vein usually less than 1.5 cm from the margin.
15a. Peduncle sharply 2–3-sided and usually winged.
16a. Blades broadest at the middle or more often above the middle, lacking a well-developed secondary collective vein, always acute at the base; spadix cylindroid, scarcely tapered, bluntly rounded at apex, smooth, the pistils scarcely emergent at apex; berries lavender white. ——— *A. dwyeri* Croat
16b. Blades broadest usually below the middle, usually with a well-developed secondary collective vein, often rounded (or even subcordate) at the base; spadix gradually long tapered, the pistil soon prominently exserted giving the spadix a rough appearance; berries lavender. ——— *A. crassiradix* var. *purpureospadix* Croat
15b. Peduncles neither triangular nor winged.
17a. Peduncle more or less equal to petiole in length.
18a. Both petioles and peduncles usually less than 6 cm long. ——— *A. kallunkiae* Croat
18b. Either petioles or peduncles usually more than 15 cm long. ——— *A. pageanum* Croat
17b. Peduncle much longer than petiole.
19a. Cataphylls drying more or less intact, not weathering to a mass of fibers; blades stiffly coriaceous, usually narrowly oblong-elliptic; spadix green, becoming violet purple or reddish; berries orange. ——— *A. paludosum* Engl.
19b. Cataphylls weathering promptly to a mass of fibers; blades thinner (coriaceous only in *A. bicollectivum*), mostly oblong-elliptic, to oblanceolate to elliptic or ovate (sometimes narrowly oblong-elliptic in *A. fragrantissimum*); spadix greenish to yellowish; berries red, white, or yellow-orange (*A. bicollectivum*).
20a. Stamens remaining exposed after anthesis (rather slow to

retract in *A. vallense,* with cataphylls weathering to reticulate fibers); leaf blades usually oblanceolate (sometimes oblong-elliptic in *A. fragrantissimum*), drying grayish green, dark brown, or blackish green.

21a. Blades drying thin, grayish green; the primary lateral veins rarely more than 10 pairs; the stamens weakly exserted on dried specimens giving the spadix a relatively coarse appearance; flowering spadix not strongly and pleasantly scented; berries white; endemic to the Serrania de Pirre. ___ *A. terryae* Standl. & L. O. Wms.

21b. Blades drying moderately thick, usually very blackened, primary lateral veins usually more than 12 pairs; the stamens on dried specimens never exserted; flowering spadix pleasantly scented during the middle of the day; berries red; restricted to the Central Cordillera, Veraguas, Coclé, Colón, and Panamá Provinces but not known from the Serranía de Pirre. ..... *A. fragrantissimum* Croat

20b. Stamens retracted beneath the tepals after anthesis (except for *A. vallense* retraction is usually prompt resulting in fewer than 4 stamens being exposed at one time for any flower); leaf blades usually drying greenish to greenish brown, never thin and grayish green or conspicuously blackened.

22a. Blades coriaceous, drying very thick, usually with 2 pairs of collective veins on each side of the midrib (at least in the lower one-fourth of the blade); spadix green, long and prominently tapered, berries yellow-orange. ..... *A. bicollectivum* Croat

22b. Blades subcoriaceous, drying moderately thin or membranous, usually without a second pair of collective veins; spadix short and green or long, becoming yellowish but not markedly tapered; berries red or white.

23a. Cataphylls 8–15 cm long, persisting as a conspicuous reticulum of pale fibers; blades 5–15 cm wide, rarely less than 7 cm wide; spadix yellowish at anthesis. ..... *A. vallense* Croat

23b. Cataphylls less than 6 cm long, not forming a conspicuous network of fibers; blades 4–7 cm wide, rarely more than 6 cm wide; spadix pale green at anthesis.

24a. Blades oblong-elliptic, drying moderately thick; the petiole sharply triangular; spadix dark green; the anthers conspicuously exposed on dried specimens; berries red; Coclé, Panamá, and Colón Provinces. ..... *A. pageanum* Croat

24b. Blades oblanceolate, drying membranous; the petioles rounded adaxially; spadix pale green, the anthers not exposed on dried specimens; berries white; Serranía de Pirre. ___ *A. terryae* Standl. & L. O. Wms.

7b. Petioles mostly more than one-third as long as blade.

25a. Blades with 2–3 pairs of collective veins, the first (closest to midrib) remote from the margin (ca. one-third the distance from the midrib to the margin), the collective veins interconnected by more or less straight, parallel secondary veins.

26a. Internodes short; blades coriaceous. ..... *A. lentii* Croat & Baker

26b. Internodes elongate; blades moderately thin. ..... *A. melastomatis* Croat

25b. Blades with usually a single collective vein (rarely with a faint second vein), usually quite close to the margin; the collective veins lacking any parallel secondary veins.

27a. Stem with elongate internodes except very near the apex; leaf blades ovate, at least half as wide as long.

28a. Spadix green to white; blades rounded at apex with a small apiculum; lower primary lateral veins spreading at nearly 90° angle from the midrib. ..... *A. subrotundum* Croat

28b. Spadix reddish or purplish; blades markedly acuminate; lower primary lateral veins spreading at nearly 45° angle from the midrib.

29a. Blades more than 7 cm wide, mostly only 1.6–1.8 times longer than wide; below 800 m; collective vein diverging from base of midrib at 60° angle. ..... *A. collinsii* Croat

29b. Blades less than 6 cm wide, mostly ca. twice as long as wide; usually above 1,000 m; collective vein diverging from base of midrib at 45° angle. ..... *A. alticola* Croat

27b. Stems with short internodes throughout; leaf blades more than 2 times longer than wide.

30a. Largest blades more than 25 cm long (sometimes less in *A. caloveboranum*).

31a. Spadix purplish at anthesis.

32a. Blades oblong-elliptic to narrowly elliptic, 8–12 cm wide, 32–38 cm long.

33a. Spadix prominently stipitate; the stipe several times longer than broad; known only from Bajo Chorro in Chiriquí Province. ..... *A. chiriquense* Standl.

33b. Spadix sessile or short-stipitate; the stipe about as broad as long; known from Provinces of Coclé and/or Panamá.

34a. Spadix with more than 9 flowers visible in the principal spiral; stamens persisting after anthesis. ..... *A. curvilaminum* Croat

34b. Spadix with 4–5 flowers visible per principal spiral; stamens retracting completely after anthesis. ..... *A. crassilaminum* Croat

32b. Blades oblong or lanceolate to narrowly ovate, less than 8 cm wide or if more than 8 cm wide, less than 30 cm long.

35a. Blades mostly 6–10 times longer than broad, mostly oblong-linear; stamens not markedly exserted on dried specimens; dried lateral tepals usually less than 2 times broader in direction of axis than perpendicular to axis. ..... *A. longistipitatum* Croat

35b. Blades 2.5–5 times longer than broad, usually narrowly ovate or lanceolate; stamens markedly exserted on dried specimens; dried lateral tepals more than 2.5 times broader in direction of axis than perpendicular to axis. ..... *A. circinatum* Croat

31b. Spadix green, whitish, or yellowish at anthesis.

36a. Spadix at anthesis less than 10 cm long.

37a. Spadix becoming yellow to whitish at anthesis (sometimes after anthesis in *A. lancifolium*).

38a. Cataphylls more than 8 cm long, conspicuously persisting more or less intact as a broad reticulum of pale fibers; spadix becoming yellowish at anthesis; berries red. ..... *A. vallense* Croat

38b. Cataphylls less than 7 cm long, weathering into loose reddish brown fibers; spadix becoming grayish white; berries white or purplish.

39a. Berries white when immature, tinged violet purple at base when mature; leaf blades narrowly ovate, 2–3.1 times longer than broad. ..... *A. lancifolium* var. *albifructum* Croat

39b. Berries solid violet purple; leaf blades various, generally narrowly oblong-elliptic but also sometimes narrowly ovate, 2.3–6(–7) times longer than broad. ..... *A. lancifolium* Schott var. *lancifolium*

37b. Spadix green at anthesis.

40a. Upper blade surface eglandular.

41a. Berries red; peduncle terete; blades usually drying grayish green; Veraguas Province. ..... *A. caloveboranum* Croat

41b. Berries probably lavender; peduncle usually 3-ribbed or winged; blades usually drying brownish; Panamá Province. ..... *A. cartiense* Croat

40b. Upper blade surface obscurely dark glandular-punctate.

42a. Petioles commonly 3-sided; blades subcoriaceous; berries red. ..... *A. pageanum* Croat

42b. Petioles usually not prominently 3-sided, more or less D-shaped; blades moderately thin; berries white. _____ *A. terryae* Standl. & L. O. Wms.

36b. Spadix at anthesis more than 10 cm long.

43a. Stamens remaining exposed, all 4 stamens of a single flower visible for some time (sometimes not evident in early fruiting stages); berries lavender, purple, or red.

44a. Blades usually oblanceolate-elliptic, broadest above the middle, sometimes oblong-elliptic, 3.6–6.4 times longer than broad, usually drying blackened, sometimes dark brown; usually with 12–17 pairs of primary lateral veins; spadix pale green to greenish white, strongly and pleasantly fragrant during midday. _____ *A. fragrantissimum* Croat

44b. Blades usually more or less elliptic to oblong-elliptic, never broadest above the middle, drying green to brown, never blackened, usually with 8–12 primary lateral veins; spadix grayish white or greenish, not strongly aromatic; berries lavender or violet purple.

45a. Spadix green and usually more than 15 cm long at anthesis; blades usually more than 3 times longer than broad; petioles 3-sided, narrowly sulcate with sharp margins; berries lavender. _____ *A. sagawae* Croat

45b. Spadix grayish white and usually less than 15 cm long at anthesis; blades usually more than 3 times longer than broad; petioles subterete, obtusely sulcate; berries violet purple. _____ *A. lancifolium* Schott var. *lancifolium*

43b. Stamens weakly exposed very briefly, no single flower with 4 stamens visible at once (rarely with 3 or 4 visible at once in *A. pirrense*); berries red.

46a. Cataphylls 8–15 cm long, persisting as a reticulum of pale fibers; spadix becoming yellowish at anthesis; leaf blades less than 2.5 times longer than broad; known only from Veraguas and Coclé Provinces. _____ *A. vallense* Croat

46b. Cataphylls usually less than 8 cm long, usually persisting as a mass of reddish brown fibers (not reticulate); spadix greenish or orange-brown; leaf blades mostly more than 2.5 times longer than broad.

47a. Spadix at anthesis tan to orange-brown, the area around the pistil tinged purplish; known only from the Serranía de Pirre, Darién Province. _____ *A. pirrense* Croat

47b. Spadix at anthesis green; not known from Darién Province.

48a. Leaf blades less than 8 cm broad, usually 3.7–5.5 times longer than broad; petiole sharply triangular with erect margins, the margins of the geniculum undulate; blades with primary lateral veins markedly impressed above; known only from Central Panama (Panamá, Coclé, and Veraguas Provinces). _____ *A. pageanum* Croat

48b. Largest leaf blades more than 8 cm wide, usually less than 3.5 times longer than broad (*A. acutangulum* rarely to 5 times); petioles not sharply triangular, narrowly sulcate but rounded abaxially, the margins of the geniculum not undulate; blades with primary lateral veins usually not markedly impressed above; widespread.

49a. Spadix 5–11 mm diam. at base at anthesis, narrower toward apex;

largest leaf blades more than 35 cm long, usually more than 13 cm wide; petioles one-sixth to one-half as long as blades, rounded abaxially; pistils purplish, not exserted; peduncles stout, deflexed but not dangling. ..... *A. ramonense* Engl. ex K. Krause

49b. Spadix 4–6 mm diam. at base at anthesis, scarcely tapered to apex; largest leaf blades to 34 cm long and 13 cm wide; petioles one-third to equally as long as blades, rounded abaxially, sometimes 1-ribbed; pistils green and weakly exserted; peduncles slender, dangling, pendent. ..... *A. acutangulum* Engl.

30b. Largest blades less than 25 cm long (rarely to 28 cm in *A. pageanum*).

50a. Spadix reddish, orange, or purplish at anthesis.

51a. Blades epunctate on lower surface, only sparsely and inconspicuously punctate on upper surface; plants growing on rocks in or along swift streams in Coclé Province; berries white or green.

52a. Spathe ovate, lavender, 1.5–2.2 cm wide; spadix violet purple; fruits white. ..... *A. amnicola* Dressler

52b. Spathe lanceolate, green, less than 1 cm wide; spadix greenish brown (at least post-anthesis); fruits green. ..... *A. sytsmae* Croat

51b. Blades conspicuously punctate on the lower surface, frequently conspicuously punctate above as well; plants not growing on rocks in swift streams in Coclé Province (except *A. rupicola*); berries red, lavender, or orange, rarely white (*A. jefense*).

53a. Spadix conspicuously stipitate, usually becoming coiled; the stipe more than 8 times longer than broad; leaf midrib on the upper surface much more markedly raised than below; berries red, depressed-globose, the apical area prominently raised. ..... *A. circinatum* Croat

53b. Spadix sessile or rarely weakly stipitate; straight or weakly curved but never becoming coiled; the stipe less than 3 times longer than broad; leaf midrib on the upper surface not more prominently raised than below; berries not as above, lavender, orange, white, or red but lacking a raised area apically (not known in *A. crassilaminum* or *A. oxystachyum*).

54a. Spadix long-tapered to a sharp point; the pistils often exserted at anthesis giving the spadix a rough appearance (fresh); berries unknown, probably lavender in *A. crassiradix* var. *purpureospadix*.

55a. Peduncles prominently 2–3-winged; veins weakly etched (i.e., veins sunken but surface perfectly flat) on the upper surface. ..... *A. crassiradix* var. *purpureospadix* Croat

55b. Peduncles terete; veins not etched above, at most weakly sunken. ..... *A. oxystachyum* Croat

54b. Spadix oblong or slightly tapered, blunt at the apex; berries yellow, orange, red, or white.

56a. Upper blade surface lacking dark, round glands; berries white, known only from vicinity of Cerro Jefe. ..... *A. jefense* Croat

56b. Upper blade surface bearing dark, round glands; berries orange or red (unknown in *A. supraglandulum*).

57a. Primary lateral and collective veins etched on upper surface of dried leaf blade; spadix at anthesis less than 3 cm long, spadix usually on a stipe which is

1–4 times longer than broad; berries orange to red. ..... *A. tutense* Croat

57b. Primary lateral and collective veins weakly raised on upper surface of dried leaf blade; spadix at anthesis usually more than 3 cm long (except sometimes in *A. supraglandulum* only 2.5 cm long); usually sessile or on a stipe that is as wide as or wider than long.

58a. Leaf blades usually lanceolate, usually broadest near the base; endemic to the Serranía de Pirre. ..... *A. cuasicanum* Croat

58b. Leaf blades broadest at the middle or above.

59a. Spadix violet purple; berries not known; known only from vicinity of Cerro Jefe. ..... *A. supraglandulum* Croat

59b. Spadix reddish, yellowish to orangish; berries orange; known only from high elevations in Chiriquí and Darién. ..... *A. alticola* Croat

50b. Spadix whitish, greenish, or yellowish at anthesis.

60a. Spadix with all the stamens remaining exposed above the tepals after anthesis (i.e., not retracted from view, although sometimes covered or obscured by the expanding tepals after berry maturation begins).

61a. Spadix markedly stipitate, the stipe many times longer than broad; mostly 1–2.5 cm long; spadix pale green.

62a. Blades more than 4 times longer than broad, up to 3 cm broad; petioles less than one-half as long as the blades; endemic to Coclé Province. ..... *A. brevispadix* Croat

62b. Blades less than 3 times longer than broad; petioles nearly as long as or 1.5 times longer than blades; endemic to the Serranía del Sapo. ..... *A. barryi* Croat

61b. Spadix sessile or short stipitate, the stipe no more than twice as broad as long; spadix yellow-green or green.

63a. Blades broadest above the middle, drying thin and usually gray-green; the petiole usually less than one-half as long as the blade; spadix scarcely tapered, pale green, blunt at apex; berries white. ..... *A. terryae* Standl. & L. O. Wms.

63b. Blades broadest below the middle, drying moderately thick, various colors but usually not gray-green; the petiole usually more than one-half as long as the blade; spadix tapered or not, green to grayish white.

64a. Blades less than 15 cm long and 3 cm wide; dried spadix less than 3 mm diam.; upper surface of blade with small raphide cells visible on dried specimens; Cerro Jefe. ... *A. gentryi* Croat

64b. Blades more than 20 cm long and 4 cm wide.

65a. Berries dark violet purple at all stages of maturation; widespread. ..... *A. lancifolium* Schott var. *lancifolium*

65b. Berries white during development, becoming faintly violet purple at base at maturity; restricted to Chiriquí Province. ... *A. lancifolium* var. *albifructum* Croat

60b. Spadix with all the stamens retracting beneath the tepals soon after anthesis, generally never with all 4 stamens of a single flower exposed at the same time.

66a. Apex of spadix tapered to a sharp point.

67a. Peduncle terete; berries green or orange.

68a. Blades oblong-elliptic, glandular-punctate on both surfaces, attenuate to narrowly acute at base, broadest at the middle; berries green. ___ *A. gracilispadix* Croat

68b. Blades lanceolate, glandular-punctate on the lower surface only, acute to obtuse or almost rounded at the base, broadest usually well below the middle; berries orange. ___ *A. oxystachyum* Croat

67b. Peduncle 2–3-winged or ribbed; berries lavender (not known in *A. crassiradix* var. *purpureospadix*).

69a. Spadix green; lower blade surface matte. ___ *A. crassiradix* Croat var. *crassiradix*

69b. Spadix violet purple; lower blade surface semi-glossy. ___ *A. crassiradix* var. *purpureospadix* Croat

66b. Apex of spadix ending abruptly, not tapered to a sharp point.

70a. Spadix at anthesis usually greater than 8.5 cm long.

71a. Cataphylls 8–14 cm long, usually persisting as a broad reticulum of pale fibers; spadix yellow to bright yellow at anthesis; berries red, moderately acute at apex; Coclé, Colón, Panamá, and Veraguas Provinces. ___ *A. vallense* Croat

71b. Cataphylls less than 8 cm long, usually weathering to a mass of tan fibers; spadix yellow-green to reddish at anthesis; berries orange or red to violet purple, depressed medially at apex (fresh berries not seen for *A. cuasicanum*).

72a. Inflorescence usually pendent; pistils conspicuously exserted at anthesis. ___ *A. acutangulum* Engl.

72b. Inflorescence usually erect; pistils scarcely or not at all exserted at anthesis.

73a. Leaf blades with a second pair of prominent collective veins.

74a. Leaf blades less than 5 cm wide; Darién Province, Serranía de Pirre. ___ *A. cuasicanum* Croat

74b. Leaf blades usually greater than 5 cm wide (if less then with petioles much shorter than blade). ___ *A bicollectivum* Croat

73b. Leaf blades lacking a second pair of prominent collective veins.

75a. Petioles triangular in cross-section; the geniculum usually with an undulate rib adaxially; spadix prominently tapered, usually yellow-green; berries red. ___ *A. pageanum* Croat

75b. Petioles terete or nearly so in cross-section; the geniculum lacking adaxial rib; spadix scarcely tapered, usually reddish; berries orange. ___ *A. cuasicanum* Croat

70b. Spadix at anthesis usually less than 8.5 cm long.

76a. Leaf blades gradually long-acuminate at apex, the acumen usually 1.5–3 cm long.

77a. Berries red to violet purple or orange; leaf blades more or less concolorous.

78a. Berries red to violet purple; leaf blades 5–10 times longer than

broad, broadest at the middle; petioles usually shorter than blade; spadix white; growing on rocks in swift streams, Coclé and Veraguas Provinces. _____ *A. rupicola* Croat

78b. Berries orange; leaf blades 3.1–3.6 times longer than wide, usually broadest well below the middle; petioles as long as or longer than the blade; spadix green to reddish; epiphyte, Darién Province, Serranía de Pirre. ____ *A. cuasicanum* Croat

77b. Berries white to pinkish white; leaf blades concolorous or markedly bicolorous.

79a. Leaf blades markedly bicolorous; Veraguas Province, Cerro Tute, 1,200 m. _____ *A. dichrophyllum* Croat

79b. Leaf blades concolorous or nearly so, not markedly bicolorous; Chiriquí Province, 1,200–1,700 m. _ _____ *A. gracililaminum* Croat

76b. Leaf blades abruptly acuminate at apex, the acumen usually less than 1 cm long.

80a. Leaf blades punctate on both surfaces.

81a. Leaf blades broadest above the middle; the interprimary veins drying almost as prominent as the primary lateral veins. _____ _____ *A. tacarcunense* Croat

81b. Leaf blades broadest at middle; the interprimary veins not as prominent as primary lateral veins.

82a. Spadix scarcely tapered to apex, fresh flowers with tepals prominently thickened on the outer margins giving a "cobbled" effect; dried tepals with the medial portion thickened and the lateral portions thin and upturned; berries pale lavender to whitish; geniculum not acutely ribbed and undulate on abaxial margin; endemic to Darién Province, Cerro Pirre. _____ *A. crassitepalum* Croat

82b. Spadix conspicuously tapered; fresh flowers lacking thickened tepals; the surface of the spadix smooth; dried flowers normal, not as above; geniculum acutely ribbed and undulate abaxially; occurring west of Canal Zone. _____ *A. pageanum* Croat

80b. Leaf blades punctate on lower surface only.

83a. Peduncle terete; petioles bluntly sulcate; roots not in dense coralloid mass; berries white; known only from Darién Province in the Serranía de Cañasas. _____ _____ *A. lactifructum* Croat

83b. Peduncle triangular, sometimes 2–5-ribbed or winged; petioles sharply sulcate; roots forming

dense coralloid mass (i.e., fleshy and contiguous); berries probably lavender; known from Colón and Panamá Provinces. ..... *A. cartiense* Croat

KEY D

Leaves cordate or subcordate, epunctate, simple.

1a. Plants scandent and twining or at least with long, slender stems with elongate internodes, held erect usually by rooting onto or being supported by trees.
2a. Stems 2–4 mm diam., usually several meters long, twining, flexible; internodes with many short roots; sea level to 1,000 m. ..... *A. flexile* Schott
2b. Stems 5–15 mm diam., usually 1 m or less long, usually stiffly erect often supported by a tree, not twining; internodes lacking roots; roots long, relatively thick, few, restricted to the nodes; usually 1,200–1,300 m.
3a. Leaf blades more than twice as long as broad.
4a. Posterior lobes less than one-eighth as long as anterior lobe; blades not conspicuously bullate.
5a. Blades widest in lower third or even at the base; usually more than 2–5 times longer than broad; widespread, Mexico to Ecuador. ..... *A. microspadix* Schott
5b. Blades usually widest at the middle or just below the middle, usually 1.5–2 times longer than broad; rare (at least in Panama), Panama and Colombia. ..... *A. myosuroides* (H.B.K) Endl.
4b. Posterior lobes ca. one-fourth as long as anterior lobe; blades conspicuously bullate. ..... *A. niqueanum* Croat
3b. Leaf blades less than twice as long as broad.
6a. Spathe less than 4 times longer than broad; spadix less than 8 times longer than broad at base.
7a. Spadix yellow-green at anthesis; leaf blades slightly bullate; cataphylls persisting intact; spathe green. ..... *A. davidsoniae* Standl.
7b. Spadix pink to lavender at anthesis; leaf blades not bullate; cataphylls subpersistent more or less intact; spathe white.
8a. Anterior lobe of leaf blade ca. 1.5 times longer than posterior lobes; vine; spathe ovate to obovate, less than 2.2 times longer than broad. ..... *A. sapense* Croat
8b. Anterior lobe of leaf blade ca. 3 times longer than posterior lobes; erect plant with long internodes near the base; spathe lanceolate, more than 2.6 times longer than broad. ..... *A. erythrostachyum* Croat
6b. Spathe more than 5 times longer than broad; spadix more than 10 times longer than broad at base.
9a. Leaf velvety above, drying with honeycombed texture; endemic to Cerro Jefe. ..... *A. folsomianum* Croat
9b. Leaf not velvety above.
10a. Blades drying blackish green; spadix yellowish at anthesis. ..... *A. hutchisonii* Croat
10b. Blades drying brown; spadix creamy white at anthesis. ..... *A. leptocaule* Croat
1b. Plants not scandent; internodes short.
11a. Spadix uniformly purplish (to reddish) at anthesis.
12a. Leaf blades lacking a posterior rib (i.e., the basal veins not joined before meeting at midrib at base).
13a. Leaf blades more than 3 times longer than broad, with basal lobes less than one-eighth as long as the anterior lobe; spadix pinkish to yellowish. ..... *A. chromostachyum* Croat
13b. Leaf blades less than 2 times longer than broad with prominent basal lobes at least one-fifth as long as the anterior lobe; spadix violet purple.
14a. Leaf blades thin with 8–10 pairs of primary lateral veins; cataphylls weathering to subpersistent fibers; spadix more than 10 cm long, more than 10 times longer than broad. ..... *A. williamsii* K. Krause
14b. Leaf blades subcoriaceous with 3–5 pairs of primary lateral veins; cataphylls persisting more or less intact; spadix less than 10 cm long, less than 6 times longer than broad. ..... *A. tysonii* Croat
12b. Leaf blades with a distinct posterior rib (i.e., some of the basal veins joined together before meeting at the midrib at base).
15a. Leaf blades more than 2 times longer than broad.
16a. Leaf blades more or less thin; spathe oblong-lanceolate; spadix usually less than 6 mm diam. at base; berries purplish. ..... *A. cuspidatum* Mast.

16b. Leaf blades subcoriaceous; spathe usually lanceolate to narrowly ovate, spadix more than 8 mm diam. at base; berries orange.
17a. Blades drying reddish brown; the basal veins usually 8–10 per side; spadix long-tapered, 24–40 times longer than broad; Darién Province. ——— *A. brownii* Mast.
17b. Blades drying green to yellow-green; the basal veins usually fewer than 7 pairs; spadix usually less than 20 times longer than broad (rarely more in *A. nervatum*); Chiriquí to Colón Provinces.
18a. Spadix with pistils sharply pointed and early emergent, usually emerging well ahead of stamens, giving spadix a prickly appearance during anthesis; spathe usually with margins markedly undulate. ——— *A. colonicum* K. Krause
18b. Spadix with pistils usually bluntly pointed or rounded at apex, not early emergent, usually emerging with or after stamens, the flowering spadix thus not prickly in appearance; spathe sometimes twisted but not markedly undulate.
19a. Primary lateral veins 19–25 pairs; berries usually acute at apex. ——— *A. nervatum* Croat
19b. Primary lateral veins 4–9 pairs; berries rounded at apex.
20a. Cataphylls 8–13 cm long; spathe usually erect, usually ovate to ovate-lanceolate (rarely lanceolate), reflexed but usually not twisted or curled. — *A. cotobrusii* Croat & Baker
20b. Cataphylls 16–32 cm long; spathe lanceolate, usually twisted or rolled. ——— *A. ranchoanum* Engl.

15b. Leaf blades less than 2 times longer than wide.
21a. Collective vein arising from one of the lowermost basal veins.
22a. Spathe oblong, more than 5 times longer than broad, green; leaf margins markedly concave; berries red. ——— *A. rubrifructum* Croat
22b. Spathe narrowly ovate to ovate or elliptic, less than 5 times longer than broad, white; leaf margins convex; berries purplish or white.
23a. Spathe more or less elliptic to obovate, ca. 1.5 times longer than broad, caudate-acuminate at apex; berries white; blade with anterior lobe ca. 2 times longer than posterior lobes. ——— *A. sapense* Croat
23b. Spathe narrowly ovate to narrowly oblong-elliptic, more than 2.5 times longer than broad, acuminate at apex; berries purplish; blade with anterior lobe ca. 3 times longer than posterior lobes.
24a. Leaf blade ovate-triangular, the margin of the anterior lobe more or less straight to slightly concave; blades drying matte. ——— *A. obtusilobum* Schott
24b. Leaf blade ovate, the margin of the anterior lobe usually convex; blades drying weakly glossy. ——— *A. formosum* Schott
21b. Collective vein not arising from one of the lowermost basal veins (i.e., lowermost basal veins running free to the margin).
25a. Spadix at anthesis less than 10 times longer than broad at base, usually scarcely tapered to apex.
26a. Spadix at anthesis less than 5 times longer than broad.
27a. Spadix at anthesis more than 2 times longer than broad; spathe hooding spadix; top of Cerro Jefe. ——— *A. kamemotoanum* Croat
27b. Spadix nearly globular, less than 2 times longer than broad; spathe erect-spreading; western Chiriquí. ——— *A. globosum* Croat
26b. Spadix at anthesis more than 5 times longer than broad.
28a. Peduncle less than 1.5 times longer than spadix; cataphylls weathering into subpersistent fibers; blades very large, mostly more than 55 cm wide. ——— *A. antonioanum* Croat
28b. Peduncle more than 2 times longer than spadix; cataphylls persisting more or less intact at least at apex; blades less than 55 cm wide.
29a. Spathe caudate-acuminate at apex; spadix pinkish.
30a. Blades coriaceous, drying thick; stems usually short, the internodes very short, usually hidden by cataphylls; Cerro Jefe. ——— *A. roseospadix* Croat
30b. Blades subcoriaceous, drying thin; stems elongate, the internodes often long, brown, cane-like, not hidden by cataphylls; Serranía de Pirre. ——— *A. erythrostachyum* Croat

29b. Spathe acuminate, the acumen not markedly elongate; spadix white to violet purple.
31a. Leaf blades less than 30 cm long, less than 20 cm wide, drying matte, the collective vein arising from the first basal vein which departs the midrib at ca. 45° and soon curves upward so the collective vein at middle of blade is very remote from the margin. ..... *A. foreroanum* Croat
31b. Leaf blades mostly more than 35 cm long and 25 cm wide, drying semiglossy, the collective vein arising from the first or second basal vein, nearly reaching margin before curving upwards. ..... *A. formosum* Schott

25b. Spadix at anthesis more than 11 times longer than broad at base, markedly tapered to apex or very long and slender.
32a. Petiole more or less quadrangular, winged; blades drying with major veins acutely raised beneath, the midrib sharply 3-ribbed beneath; endemic to Bocas del Toro. ..... *A. teribense* Croat
32b. Petiole more or less terete; blades drying with major veins not acutely raised, the midrib not sharply 3-ribbed beneath.
33a. Peduncles less than 1.5 times longer than spadix. ..... *A. rotundistigmatum* Croat
33b. Peduncles more than 2 times longer than spadix.
34a. Stamens long-exserted, remaining long-exserted, the anthers not retracting to the edge of the tepals.
35a. Blades ovate-triangular to sub-3-lobed, the posterior lobes often longer than broad; usually below 2,000 m. ..... *A. watermaliense* Hort. ex L. H. Bailey
35b. Blades narrowly ovate, the basal lobes about as long as broad; above 2,000 m. ..... *A. concinnatum* Schott
34b. Stamens not long-exserted or soon retracting to edge of tepals.
36a. Inflorescence usually longer than the leaves; tertiary veins drying prominent on both sides. ..... *A. brownii* Mast.
36b. Inflorescence equalling to shorter than the leaves; tertiary veins drying more or less obscure to prominulous.
37a. Blades with 10 or fewer primary lateral veins per side; plants terrestrial.
38a. Spadix lavender with a green tip; petiole faintly many ribbed; berries purple. ..... *A. pluricostatum* Croat & Baker
38b. Spadix purplish throughout or green tinged purple; petiole terete; berries orange. ..... *A. standleyi* Croat & Baker
37b. Blades usually with 12 or more primary lateral veins per side; plants epiphytic or terrestrial.
39a. Leaf blades less than 62 cm long, usually drying green with reddish tinge along and on major veins on lower surface; pistils early emergent. ..... *A. cuspidatum* Mast.
39b. Leaf blades often more than 65 cm long, drying pale green or more or less reddish brown throughout; pistils not early emergent.
40a. Blades drying thin, yellowish green, usually with the uppermost 2 or 3 basal veins not merging before meeting at midrib. ..... *A. dukei* Croat
40b. Blades drying coriaceous, red-

dish brown, with only the uppermost basal vein not merging with the other basal veins before meeting at midrib. ..... *A. brownii* Mast.

11b. Spadix not uniformly purplish or reddish at anthesis.
41a. Leaf blades more than twice as long as broad.
42a. Spadix at anthesis less than 10 times longer than broad at base; cataphylls subpersistent, remaining more or less intact (weathering at base only in *A. cotobrusii*).
43a. Spadix white at anthesis, hooded by spathe; blade with lower surface densely and minutely dark dotted. ..... *A. cucullispathum* Croat
43b. Spadix green, yellow, or tinged with purple.
44a. Leaf blades ca. 3 times longer than broad; cataphylls subpersistent, reddish brown, more or less intact; pistil emerging without ribs. ..... *A. chromostachyum* Croat
44b. Leaf blades less than 2.5 times longer than broad; cataphylls subpersistent, tan, weathering at base; pistils emerging quadrangular with 4 ribs running from the center to the corners. ..... *A. cotobrusii* Croat & Baker
42b. Spadix at anthesis more than 10 times longer than broad at base; cataphylls remaining intact or weathering into subpersistent fibers.
45a. Petioles ribbed.
46a. Petiole more or less quadrangular, the margins weakly winged (at least when dried); blades drying with major veins acutely raised beneath, the midrib sharply 3-ribbed; endemic to Bocas del Toro. ..... *A. teribense* Croat
46b. Petioles more or less with several low ribs; blades drying with major veins obtusely raised beneath, the midrib not prominently ribbed; Veraguas to Darién. ..... *A. panamense* Croat
45b. Petioles not ribbed, more or less terete, usually sulcate adaxially.
47a. Cataphylls thick, deciduous intact, not weathering into fibers; leaf blades more than 2.5 times longer than broad.
48a. Leaf blades broadest above the base, more than 3.5 times longer than broad, more than 50 cm long; basal veins free to the base, not coalescing into a posterior rib. ..... *A. hebetatum* Croat
48b. Leaf blades broadest at base, less than 3 times longer than broad, less than 41 cm long; basal veins usually coalescing to form a posterior rib.
49a. Leaf blades coriaceous, drying with tertiary veins conspicuously raised; 7–9 flowers visible in each spiral. ..... *A. cinereopetiolatum* Croat
49b. Leaf blades moderately thin, drying with tertiary veins not prominently raised; 4–5 flowers visible in each spiral. ..... *A. chorranum* Croat
47b. Cataphylls moderately thin, weathering into subpersistent fibers or fragments; leaf blades less than 2.5 times longer than broad (except sometimes *A. cuspidatum*).
50a. Plants epiphytic; leaf blades moderately bullate, at least the major veins prominently sunken above; collective vein formed from one of the lowermost basal veins. ..... *A. niqueanum* Croat
50b. Plants terrestrial; leaf blades not bullate; collective vein usually formed from the uppermost basal vein (rarely loop-connected from the lower basal veins in *A. ochranthum*).
51a. Blades velvety on upper surface; spadix green at anthesis with 4 flowers visible in each spiral from any angle. ..... *A. papillilaminum* Croat
51b. Blades not velvety; spadix green turning bright yellow at anthesis with 6–10 flowers visible in each spiral. ..... *A. ochranthum* C. Koch
41b. Leaf blades less than twice as long as broad.
52a. Petiole conspicuously ribbed or angled; usually terrestrial; berries purple at apex, white at base.
53a. Petiole triangular, the margins 1–2-winged; blade not velvety above; pollen orange. ..... *A. cerrocampanense* Croat
53b. Petiole subterete with 4–7 ribs; blades velvety above; pollen white. ..... *A. dressleri* Croat
52b. Petiole not ribbed, not angled; usually epiphytic; berries various colors.

54a. Blades velvety green with pale venation on upper surface; spadix yellow. ____ *A. crystallinum* Linden & André

54b. Blades not velvety (except *A. folsomianum*), not with markedly paler venation on upper surface; spadix white, green, or yellow.

55a. Spadix yellow at anthesis.

56a. Spadix less than 4 cm long, with usually ca. 3 flowers visible in each spiral; leaf blades less than 25 cm long; stem less than 1 cm diam. ____ *A. pauciflorum* Croat

56b. Spadix more than 4 cm long at anthesis, with 5 or more flowers visible in each spiral; leaf blades usually more than 25 cm long; stems more than 1 cm diam.

57a. Leaf blades ovate-cordate, the margin broadly rounded; the posterior lobes directed backward or inward. ____ *A. coloradense* Croat

57b. Leaf blades ovate-triangular to panduriform, the outer margin usually concave where the posterior lobes begin, the posterior lobes directed outward or backward.

58a. Dried blades shiny beneath; blades panduriform, with more than 6 primary lateral veins per side; the posterior lobes either suborbicular or elongated and directed prominently outward; berries pale green. ____ *A. panduriforme* Schott

58b. Dried blades matte beneath; blades mostly ovate-triangular, rarely panduriform, with 4–6 primary lateral veins per side; the posterior lobes triangular to elongate and rounded and directed downward or slightly outward. ____ *A. ochranthum* C. Koch

55b. Spadix white or green at anthesis.

59a. Cataphylls persisting intact, thick, reddish brown; spadix usually white at anthesis; blades mostly ovate-cordate, coriaceous, usually drying with linear raphide cells visible at least on upper surface.

60a. Spadix more than 17 times longer than broad, prominently tapered toward apex.

61a. Leaf blades drying black or greenish black, usually more than 50 cm long; spadix yellow-green, more than 25 cm long at anthesis. ____ *A. colonense* Croat

61b. Leaf blades not drying blackened, mostly less than 50 cm long; spadix white at anthesis, mostly less than 25 cm long at anthesis. ____ *A. curvispadix* Croat

60b. Spadix less than 15 times longer than broad at anthesis, mostly blunt and scarcely tapered to apex.

62a. Spadix pale green at anthesis, less than 5 times longer than broad; spathe less than 2.5 times longer than broad. ____ *A. fusiforme* Croat

62b. Spadix white at anthesis, more than 5.5 times longer than broad; spathe more than 2.5 times longer than broad.

63a. Spathe brittle, thin, abruptly short-acuminate; leaf blade with primary lateral veins beneath drying reddish brown. ____ *A. ravenii* Croat & Baker

63b. Spathe coriaceous, not brittle, long-acuminate; leaf blade with primary lateral veins beneath not drying reddish brown.

64a. Leaf blades matte beneath when fresh, usually less than 55 cm long; plant usually terrestrial; berries violet purple at apex, paler at base. ____ *A. sanctifidense* Croat

64b. Leaf blades glossy beneath when fresh, size various; plants usually epiphytic.

65a. Leaf blades mostly more than 55 cm long; spadix white at anthesis, quickly turning pale violet purple with early emergent, sharply pointed pistils; berries violet purple, at least at apex. ____ *A. formosum* Schott

65b. Largest leaf blades less than 55 cm long; spadix white at anthesis, remaining creamy white, the pistils not early emergent; berries red. ..... *A. hoffmannii* Schott

59b. Cataphylls not persisting intact, moderately thin, either deciduous or weathering into subpersistent fibers (rarely persisting more or less intact but not reddish brown); spadix white or green; blades ovate-cordate, thin or thick, mostly lacking visible linear raphide cells when dry.

66a. Collective vein arising from one of the lowermost basal veins.

67a. Spadix with more than 10 flowers visible in each spiral, the stamens prominently exserted at anthesis, the pistils early emergent; leaf blades ovate with convex margins. ..... *A. caperatum* Croat & Baker

67b. Spadix with less than 7 flowers visible in each spiral, the stamens not long exserted, the pistils not early emergent; leaf blades ovate-triangular with more or less straight margins or more or less panduriform with concave margins.

68a. Plants terrestrial; spadix long-tapered, usually becoming golden yellow at anthesis with the pollen oozing from beneath the tepals. ..... *A. ochranthum* C. Koch

68b. Plants epiphytic; spadix long-tapered or not, green, with anthers exposed and bearing pollen.

69a. Leaf blade panduriform, the margin markedly concave between the anterior and posterior lobes; tertiary veins not prominent on lower surface. ..... *A. rubrifructum* Croat

69b. Leaf blade ovate-triangular, the margin more or less straight; tertiary veins prominent on lower surface. ..... *A. malianum* Croat

66b. Collective vein arising from one of the uppermost basal veins.

70a. Plants terrestrial.

71a. Spathe usually purple; stamens prominently exserted, remaining exserted; leaf blades with posterior lobes usually more than 1.5 times longer than broad. ... *A. watermaliense* Hort. ex L. H. Bailey

71b. Spathe green; stamens not prominently exserted or if so, soon retracting; leaf blades with posterior lobes mostly broader than long.

72a. Margin of blade usually straight to concave; pollen oozing from beneath tepals; berries dark purplish at apex, white at base. ..... *A. ochranthum* C. Koch

72b. Margin of blade usually convex; anthers exserted; berries orange (not known in *A. coloradense*).

73a. Collective vein arising from the first basal vein or from one of the primary lateral veins; spadix with 5–10 flowers visible in each spiral. ..... *A. standleyi* Croat & Baker

73a. Collective vein arising from the third basal vein; spadix with ca. 5 flowers visible in each spiral. ..... *A. coloradense* Croat

70b. Plants epiphytic.

74a. Spadix pale green, turning purplish; spathe moderately coriaceous, persisting intact; fruits orange; cataphylls promptly weathering to fibers; above 2,000 m in western Panama. ... *A. concinnatum* Schott

74b. Spadix maroon; spathe moderately thin, soon damaged or fallen; fruits red; cataphylls (at least uppermost) remaining intact; below 1,600 m in eastern Panama. ..... *A. dukei* Croat

KEY E

Leaves simple, not lobed; not dark glandular-punctate, not cordate or subcordate at base.

1a. Plants with the stem elongate with long internodes (1 cm or more), the leaves usually dispersed throughout much of the length of the stem.
2a. Spathe decurrent on the peduncle (0.5–)1–1.5 cm; berries yellow to orange or white.
3a. Internodes short, usually less than 1 cm long (rarely to 2 cm long); blades mostly more than 3 times longer than broad; primary lateral veins 13–20 pairs, mostly drying obscure. ..... *A. pittieri* Engl. var. *pittieri*
3b. Internodes elongate, 1–8.5 cm long (mostly 1–2.5 cm); blades mostly less than 3 times longer than broad; primary lateral veins mostly 7–9 pairs, drying moderately conspicuous. ..... *A. pittieri* var. *morii* Croat
2b. Spathe essentially not decurrent; berries green, yellow, orange, or bright red to red-violet.
4a. Stems with 2 or more successive, abbreviated internodes, 8–33 cm long; leaves drying brownish green or olive green; berries bright red or red-violet; below 1,000 m. ..... *A. interruptum* Sodiro
4b. Stems with internodes nearly uniform in length, decreasing slightly toward the apex of the stem; leaves drying dark brown to blackish or pale green; berries green, red, or orange; usually above 1,200 m, rarely below 1,000 m (except *A. coclense* 500–1,000 m).
5a. Blades drying black or blue-black, dark brown on the upper surface, medium brown on the lower surface; 1,500–2,600 m; leaves fleshly when fresh with veins obscure. ..... *A. carnosum* Croat & Baker
5b. Blades drying dark green to pale green above, pale yellow-green or occasionally brownish beneath; 500–2,300 m; leaves thickly chartaceous with veins prominent below.
6a. Spadix slender and narrowly tapered to apex, more than 7 cm long at anthesis; berries red, early emergent, oblong. ..... *A. testaceum* Croat & Baker
6b. Spadix blunt and scarcely tapered to apex, usually less than 7 cm long at anthesis; berries yellow-green or red, not early emergent, more or less globose or ovoid.
7a. Leaf blades mostly more than 10 cm wide; peduncles usually less than one-half as long as petioles; berries red. ..... *A. coclense* Croat
7b. Leaf blades mostly less than 10 cm wide; peduncles usually more than one-half as long as petiole; berries yellow-green.
8a. Petioles mostly more than 15 cm long; leaf base acute to rounded; stipe 1–5 mm long; leaves usually clustered at the ends of branches (internodes short) with the more elongate lower nodes usually leafless. ..... *A. pallens* Schott
8b. Petioles mostly less than 15 cm long; leaf base often truncate or subcordate; stipe 2–10 mm long; leaves evenly distributed along the branches and persistent, the apical internodes not usually shortened. ..... *A. microspadix* Schott
1b. Plants erect or pendent with a generally short stem with short internodes, the leaves usually clustered near the apex of the stem, often with a rosulate habit.
9a. Leaf blades with the primary lateral veins in at least the lower one-fourth of blade running to the margin, not forming a collective vein in the basal one-fourth.
10a. Spadix purplish at anthesis (lavender to violet purple).
11a. Peduncle usually shorter than petiole, never more than 2 times longer than petiole, less than twice as long as spadix; spadix lavender to violet purple at anthesis; berries red.
12a. Petioles usually sharply quadrangular; the spadix dark violet purple; Atlantic coast to the Continental Divide in wetter parts of tropical moist forest and premontane wet forest. ..... *A. purpureospathum* Croat
12b. Petioles subterete to obscurely quadrangular, usually rounded adaxially; the spadix whitish to lavender at anthesis; Pacific coast in tropical dry forest and drier parts of tropical wet forest. ..... *A. cubense* Engl.
11b. Peduncle mostly 2 or more times longer than petiole, more than twice as long as spadix; spadix violet purple at anthesis; berries orange, red, or purple.
13a. Cataphylls cucullate (hooded), fist-shaped before opening (the new leaf unrolling like a fern frond); inflorescence frequently pendent at anthesis; spadix pale lavender, weakly glaucous; spathe narrowly lanceolate, almost as long as the spadix at anthesis. ..... *A. salviniae* Hemsl.
13b. Cataphylls lanceolate (the new leaf not rolled longitudinally); inflorescences erect at anthesis; spadix usually dark violet purple, not glaucous; spathe much shorter than spadix or if longer then more or less oblong to narrowly ovate or oblong-lanceolate.
14a. Spathe narrowly ovate to ovate-lanceolate, 2–11 cm wide, usually dark violet purple, erect and hooding the spadix. ..... *A. luteynii* Croat
14b. Spathe linear-lanceolate to oblong-ovate or oblong-elliptic, usually less than 2 cm wide, usually green.
15a. Pistils early emergent and acute, much longer than the stamens at anthesis; the berries white at base, reddish to purplish at apex. ..... *A. consobrinum* Schott

15b. Pistils not early emergent, rounded at apex, usually shorter than the stamens at anthesis; the berries purple or red.
16a. Pollen yellow, fading white; berries purple; spadix sharply tapered, spathe usually narrowly lanceolate, soon withering. ____ *A. fendleri* Schott
16b. Pollen lavender; berries red; spadix scarcely tapered to a blunt apex, spathe more or less oblong, persistent intact. ____ *A. concolor* K. Krause

10b. Spadix green or yellow-white at anthesis.
17a. Spadix clavate, less than 6 cm long, yellowish white; spathe cucullate, hooding spadix. ____ *A. cuneatissimum* (Engl.) Croat
17b. Spadix broadest at base, long-tapered to apex, more than 6 cm long, green; spathe not cucullate.
18a. Stems lacking markedly shortened internodes with numerous, closely aggregated roots; blades thin, lanceolate to narrowly elliptic, arching, lacking rosulate habit; leaf vernation supervolute. ____ *A. cerropirrense* Croat
18b. Stems markedly shortened with short internodes and numerous usually closely aggregated roots; blades moderately thick, oblanceolate, oblong-lanceolate with a rosulate habit or strap-shaped and many times longer than broad; leaf vernation involute.
19a. Long pendent epiphyte, usually suspended by few roots; petioles rounded abaxially, not ribbed; blades at least 3 times longer than broad; spathe usually purple, twisted or contorted at anthesis; berries orange; pistil early exserted. ____ *A. pseudospectabile* Croat
19b. Erect, bird's nest epiphytes or terrestrial; petioles quadrangular or ribbed abaxially; blades less than 3 times longer than broad; spathe green, not twisted; berries various.
20a. Plants usually terrestrial; blades prominently attenuate toward base, gradually tapering onto petioles; berries yellow-green; roots not in a massive cluster with many directed upwards. ____ *A. acutifolium* Engl.
20b. Plants epiphytic; blades narrowing toward base but ending abruptly on petiole; berries white; roots in a massive cluster with many directed upward. ____ *A. fatoense* K. Krause

9b. Blades with a collective vein arising in the basal one-fourth.
21a. Spadix purplish at anthesis.
22a. Spadix with 2–3 flowers visible in each spiral from any angle; cataphylls persisting intact; primary lateral veins scarcely distinguishable from interprimary veins; berries red. ____ *A. gracile* (Rudge) Lindl.
22b. Spadix with 4 or more flowers visible in each spiral; cataphylls weathering into fibers; primary lateral veins much more prominent than the interprimaries; berries orange or red (not known in *A. cerropirrense*).
23a. Primary lateral veins and collective vein prominently sunken above, prominently raised beneath.
24a. Spadix 2–6 cm long at anthesis, on a short stipe; the spathe frequently ovate, usually more or less hooding the spadix. ____ *A. protensum* Schott ssp. *arcuatum* Croat
24b. Spadix usually more than 10 cm long, sessile; the spathe usually oblong-lanceolate, often becoming coiled. ____ *A. seibertii* Croat & Baker
23b. Primary lateral veins and collective vein not prominently sunken above, slightly raised beneath.
25a. Leaf blades more than 6 times longer than broad, usually broadest near middle. ____ *A. cerropirrense* Croat
25b. Leaf blades less than 5 times longer than broad, usually broader at the base than at the middle.
26a. Leaf blades thin, often drying with reddish discolorations along the major veins; the spadix scarcely or not at all tapered toward the apex with 4–5 flowers visible in the principal spiral from any angle. ____ *A. cuspidatum* Mast.
26b. Leaf blades coriaceous, not drying with reddish discolorations; the spadix prominently tapered with 7–9 flowers visible in the principal spiral from any angle. ____ *A. validifolium* K. Krause

21b. Spadix green, yellow, or white, not purplish.
27a. Spadix sessile or nearly so.
28a. Plant pendent; leaves usually more than 1 m long; spathe purplish. ____ *A. pseudospectabile* Croat
28b. Plants erect; leaves usually less than 70 cm long; spathe green.

29a. Spadix clavate; petiole sharply 3–4-sided. ..... *A. spathiphyllum* N. E. Brown
29b. Spadix broadest at base, slightly to prominently tapered toward apex; petiole terete.
30a. Spadix narrowly and sharply tapered to apex, with 5–10 flowers visible in each spiral. ..... *A. angustispadix* Croat & Baker
30b. Spadix scarcely narrowing toward apex.
31a. Leaf blades less than 7 cm wide; spadix with 2–4 flowers visible in each spiral; usually above 1,000 m. ..... *A. pallens* Schott
31b. Blades more than 10 cm wide; spadix with 7–10 flowers in each spiral; usually below 1,100 m. ..... *A. coclense* Croat
27b. Spadix conspicuously stipitate.
32a. Petioles less than one-third as long as blades.
33a. Spadix at anthesis less than 2 cm long.
34a. Leaf blades broadest at middle; roots flattened, ribbon-like. ..... *A. platyrhizum* Croat
34b. Leaf blades broadest above the middle; roots not flattened and ribbon-like.
35a. Spathe lanceolate, long-decurrent onto peduncle; spadix much longer than broad at anthesis. ..... *A. correae* Croat
35b. Spathe ovate, scarcely decurrent onto peduncle; spadix nearly globular. ..... *A. llanense* Croat
33b. Spadix at anthesis more than 2 cm long.
36a. Leaf blades conspicuously broadest above the middle; berries purple.
37a. Spathe markedly decurrent onto peduncle; blades usually drying black; spadix at anthesis less than 3 cm long. ..... *A. correae* Croat
37b. Spathe scarcely decurrent; blades usually drying green; spadix usually more than 3 cm long at anthesis.
38a. Spadix at anthesis yellow. ..... *A. wedelianum* Croat ssp. *wedelianum*
38b. Spadix at anthesis green. ..... *A. wedelianum* ssp. *viridispadix* Croat
36b. Leaf blades not conspicuously broadest above the middle; berries orange or purple.
39a. Spathe usually tinged purple, longer than spadix even in fruit, hooding spadix; spadix usually lavender, rarely greenish; berries orange; blades drying green; primary lateral veins and collective vein prominently raised beneath. ..... *A. protensum* Schott ssp. *arcuatum* Croat
39b. Spathe green, soon shorter than spadix, reflexed; spadix green; berries purple or white or orange; blades usually drying dark.
40a. Blades subcoriaceous, drying with reticulate veins obscure; spathe conspicuously decurrent; pistils early emergent (before stigmas are receptive), pointed at apex; stamens much shorter than pistil at anthesis; berries orange to white. ..... *A. pittieri* Engl. var. *pittieri*
40b. Blades moderately thin (at least when dry) drying with reticulate veins prominent; spathe scarcely or not at all decurrent; pistils not early emergent, stamens longer than the pistil at anthesis; berries purple, sometimes white at base. ..... *A. michelii* Guillaumin
32b. Petioles more than one-third as long as blades.
41a. Spathe purple, nearly as broad as long; spadix cream, less than 3 cm long. ..... *A. hammelii* Croat
41b. Spathe green, sometimes tinged purple, at least twice as long as broad; spadix green.
42a. Spadix less than 1.5 cm long, half as broad; roots flattened, ribbon-like. ..... *A. platyrhizum* Croat
42b. Spadix more than 2 cm long, more than twice as long as broad; roots not flattened.
43a. Spathe conspicuously decurrent; blades subcoriaceous, drying with the primary lateral veins scarcely raised, scarcely more conspicuous than the interprimary veins; berries white, yellow to orange; pistils early emergent, much longer than stamens at anthesis. ..... *A. pittieri* Engl. var. *pittieri*
43b. Spathe scarcely or not decurrent; blades moderately thin, drying with the primary lateral veins usually prominent, usually more

conspicuous than the interprimaries; pistils not early emergent, not longer than stamens at anthesis; berries red, orange, white, or purple (not known in *A. cerropirrense*).

44a. Peduncles usually less than one-half as long as the petioles; blades usually rounded at base. ..... *A. coclense* Croat

44b. Peduncles usually about as long as or longer than the petioles; blades usually acute to obtuse at the base.

45a. Blades much paler beneath when fresh, frequently drying blackened, the midrib and petiole acute abaxially; berries purple. ..... *A. michelii* Guillaumin

45b. Blades only slightly paler beneath, usually drying green, the midrib and petiole rounded abaxially.

46a. Spathe ovate to ovate-lanceolate, frequently purplish, usually longer than spadix even in fruit; petiole sometimes 3-ribbed abaxially; berries orange. ..... *A. protensum* Schott ssp. *arcuatum* Croat

46b. Spathe lanceolate to oblong-lanceolate, usually green (sometimes purple in *A. cerropirrense*) soon shorter than spadix; petioles terete; berries greenish or red (not known in *A. cerropirrense*).

47a. Spadix at anthesis less than 4.5 cm long, scarcely tapered to apex, stubby; berries yellowish green. ..... *A. pallens* Schott

47b. Spadix more than 5 cm long at anthesis, either very long and slender or conspicuously tapered to apex; berries red or purple.

48a. Spadix with 4–7 flowers visible per spiral; tepals flat, not clearly distinguished from one another by a sunken line, the internodes very short; berries purple at maturity; Darién Province on Serranía de Pirre. ..... *A. cerropirrense* Croat

48b. Spadix with usually about 3 flowers visible per spiral; tepals prominently elevated, clearly distinguished from one another by a sunken line between the flowers; the internodes visibly elongated except at the apex; berries red at maturity; Chiriquí Province and adjacent Costa Rica. ___ *A. testaceum* Croat & Baker

Anthurium acutangulum Engl., Bot. Jahrb. Syst. 25: 371. 1898. TYPE: Costa Rica. San José: near San José, 1,200 m, *Tonduz 10360* (B, hololectotype; CR, isolectotype; designated by Croat & Baker, 1979).

Anthurium porschianum K. Krause, Ann. Naturhist. Mus. Wien 46: 231. 1933. TYPE: Costa Rica. Limón: La Castilla-Los Negritos, 12 km from the mouth of the Río Reventazon, 20 m, *Cufondontis 611* (W, holotype; B, isotype).

Epiphyte or rarely terrestrial; stems short; cataphylls drying tan, persisting as linear fibers; petioles narrowly sulcate, rounded to 1-ribbed, 3–22 cm long, 4–7 mm diam.; blade elliptic to narrowly obovate, subcoriaceous, acute to obtuse at base, 15–34 cm long, 5–14 cm wide, lower surface glandular-punctate. Inflorescence spreading to pendent; peduncle 12–61 cm long, 4–4.5 mm diam., terete to strongly ribbed abaxially; spathe oblanceolate, green, tinged with red-violet, 7–11.5 cm long, 1.2–1.5 cm wide; spadix stipitate, yellow-green, 8.5–21 cm long, 4–6 mm diam. at base; berries pale orange, more or less obovoid, ca. 5 mm long. See Croat (1983: 242) for a more complete description.

The species is known from Honduras (La Mos-

quitia) to Panama from sea level to 1,400 m. It is found only on the Atlantic slope in Honduras and Nicaragua but on both slopes in Costa Rica and Panama. In Panama it occurs on the Pacific slope near the Continental Divide. *Anthurium acutangulum* is known from wetter parts of tropical moist, premontane wet, and tropical wet forest.

Anthurium acutangulum is a member of section *Porphyrochitonium* and is recognized by its more or less elliptic, punctate leaves, its slender pendulous, usually pinkish peduncle, its pinkish spathe, and its pale orange berries.

BOCAS DEL TORO: vicinity Luzón, *Kennedy 3244* (MO); near Río Terebé, *Kirkbride & Duke 644* (MO).

CANAL ZONE: Barro Colorado Island, *Croat 4347B, 6740, 11274* (MO); Summit Gardens, *Croat s.n., 17145* (MO); near Gatún, *Hayes 497* (NY); Río Indio, *Maxon 4865* (NY), *Pittier 2799* (US).

COLÓN: Aguacote, *Hammel 4431* (MO); Guásimo, *Croat 9963* (MO); NW of Mina Boquerón, *Knapp & Sytsma 2399* (MO); road between Portobelo & Nombre de Dios, *Croat 33557* (MO, US), *33634A* (MO), *49799* (FTG, MO); vicinity Peluca, *Kennedy 2662* (MO); at mouth of Río Boquerón, *Carrasquilla et al. 374* (MO); along Río Sirí, *Pittier 4024* (US); Santa Rita Lumber Road, E of Agua Clara Rain Gauge, *Witherspoon et al. 8317* (MO).

PANAMÁ: El Llano-Cartí Road, *Hammel 840* (MO), *Knapp 1817* (MO), *Wilbur & Luteyn 19496* (DUKE); N of Margarita on road to Madroño, *Hammel 6016* (MO, PMA); above Pan-American Hwy. on trail from El Llano to Cartí-Tupile, *Kennedy 1788, 2564* (MO).

Anthurium acutifolium Engl., Bot. Jahrb. Syst. 25: 365. 1898. TYPE: Costa Rica. Puntarenas: along the Río Hakum, Buenos Aires (SE of San Isidro del General), 250 m, *Pittier 6539* (B, hololectotype; BR, CR, isolectotypes; designated by Croat & Baker, 1979).

Anthurium scopulicola Standl. & L. O. Wms., Ceiba 3: 105. 1952. TYPE: Costa Rica. Puntarenas: vicinity of Palmar Norte, near sea level, *Allen 5788* (EAP, holotype; F, isotype).

Terrestrial or rarely epiphytic; cataphylls persisting as fibrous network; petioles flattened to broadly sulcate adaxially, sharply 3-ribbed abaxially, 6–22 cm long, 6–9 mm diam., blade oblanceolate to broadly oblanceolate, long attenuate at base, 25–62 cm long, 5.5–27 cm wide. Inflorescence erect; peduncle 24–53 cm long, 3–5 mm diam.; spathe green, linear-lanceolate, 5–12 cm long, 0.7–1.1 cm wide; spadix sessile, green to white, sometimes tinged red-violet, 7–16 cm long, 6–8 mm diam. at base; berries greenish yellow, obovoid, often not developed in apical one-fourth to one-half of spadix. See Croat (1983: 244) for a more complete description.

The species is known from Costa Rica and Panama in tropical moist, premontane wet, and tropical wet forest life zones from sea level to 900 m. The species has been collected in Panama on the Burica Peninsula in Chiriquí Province.

Anthurium acutifolium is a member of section *Pachyneurium* and is distinguished by being a terrestrial plant (rarely epiphytic) with thin, oblanceolate to broadly lanceolate leaf blades that are attenuate at the base. It is similar vegetatively to *A. consobrinum* but does not have the early emergent pistils characteristic of that species.

CHIRIQUÍ: W of Puerto Armuelles, *Croat 21938, 21972* (MO), *22474* (MO, PMA), *Liesner 49* (MO); vicinity Puerto Armuelles, *Woodson & Schery 904* (MO).

Anthurium alticola Croat, sp. nov. TYPE: Panama. Chiriquí: Cerro Colorado, along road to copper mining area N of San Félix, 8°33′N, 81°52′W, 1,500 m, *Antonio 1513* (MO 2782437, holotype).

Planta epiphytica; caudex usque 25 cm longus; cataphyllum persistens, plus minusve intactum aut findens in fibris grossis; petiolus 6–16 cm longus; lamina ovato-elliptica ad oblongo-elliptica, apice brevi acuminata, basi obtusa aut subrotunda, 8–15 cm longa, 3.5–6.5 cm lata, utrinque glanduloso-punctata; inflorescentia erecta et effusa; pedunculus 8–18 cm longus; spatha viride suffusa rubescens, spadix rubescens, 4–9 cm longus; baccae globosae, luteae aut aurantiacae.

Epiphyte; stems to 25 cm long, 1.5–2.5 cm diam.; internodes to 1.5 cm long on lower part of stem, shorter near apex; roots sparse, long, slender; cataphylls 3–6 cm long, drying reddish brown, persisting more or less intact or weathering into coarse fibers. LEAVES erect-spreading; petioles 6–16 cm long, ca. 3–4 mm diam., sulcate, rounded abaxially; geniculum ca. 1.5 cm long; blades ovate-elliptic to oblong-elliptic, abruptly acuminate at apex (the acumen ca. 1 cm long, downturned), obtuse to subrounded (rarely acute) at base, 8–15 cm long, 3.5–6.5 cm wide, broadest near middle or below, both surfaces glandular-punctate; midrib raised on both surfaces; primary lateral veins 10–13 per side, departing midrib at 45° angle, drying raised above and below; interprimary veins drying raised above and below; collective vein arising from near the base, 5–10 mm from margin. INFLORESCENCE erect-spreading, equalling or longer than

leaves; peduncle 8–18 cm long, ca. 3 mm diam., equalling or to 3 times longer than petioles; spathe moderately thin, green, sometimes tinged red, oblong-lanceolate, 3.5–4.5 cm long, 0.6–1 cm wide, broadest near base, acuminate at apex, obtuse at base, inserted at 45–60° angle on peduncle; spadix reddish to rust or maroon, 4–9 cm long, 3–5 mm diam. near base, 2–3 mm diam. near apex; flowers (dry) rhombic, ca. 3.5 mm long, 1.5–2 mm wide, the sides straight to weakly sigmoid; 3–5 flowers visible in either spiral; lateral tepals 1.5–1.6 mm wide, the inner margin broadly rounded; pistils not emergent; stamens probably quickly retracting, not visible on dry specimens. INFRUCTESCENCE with spadix ca. 11 cm long, 6–10 mm diam., berries (dry) round, yellow or orange, 2–3 mm long, ca. 2–3 mm diam., with 4 weak ridges radiating from apex; seeds 1 or 2 (2 berries observed), whitish, ca. 2 mm long, 1.2–1.6 mm wide, ca. 0.8 mm thick, with a gelatinous appendage at one end only. Fig. 1.

Anthurium alticola is known from Panama and Colombia at elevations of 1,300 to 1,900 m in tropical wet, premontane rain, and lower montane forest life zones.

The species, a member of section *Porphyrochitonium*, is characterized by its epiphytic habit, its long-petiolate, ovate-elliptic to oblong-elliptic, acuminate leaves, its frequently pinkish to red spathe, its generally reddish to rust or maroon spadix, and its yellow or orange berries.

The species occurs only at higher elevations, thus the name from the Latin "altus" (high) and "colo" (to dwell). It is represented in Panama by collections in Chiriquí and Bocas del Toro in western Panama and on Cerro Tacarcuna on the border between Darién and Chocó in Colombia. Some Chiriquí collections, notably *Hammel 2266* and *Folsom & Dressler 5429*, have elongate lower internodes and lack the persistent cataphylls more typical of the species.

The species has been described making use of only dried material. As a result, many of the details are not known, and the species remains among the most poorly understood. Eventual study of live material may well result in the separation of the collections into two or more taxa.

BOCAS DEL TORO: ENE of Cerro Pata de Macho, *Hammel 6172* (MO).

CHIRIQUÍ: between Alto de Guayabo & Continental Divide, *Correa et al. 2846* (MO); Cerro Colorado, *Antonio 1513* (MO); Fortuna Dam site, *Croat 48648* (MO), *Folsom et al. 5429* (MO); La Fortuna, *Hammel 2129, 2266* (MO); N of San Félix at Chiriquí-Bocas del Toro border, *Mori & Kallunki 5851* (MO).

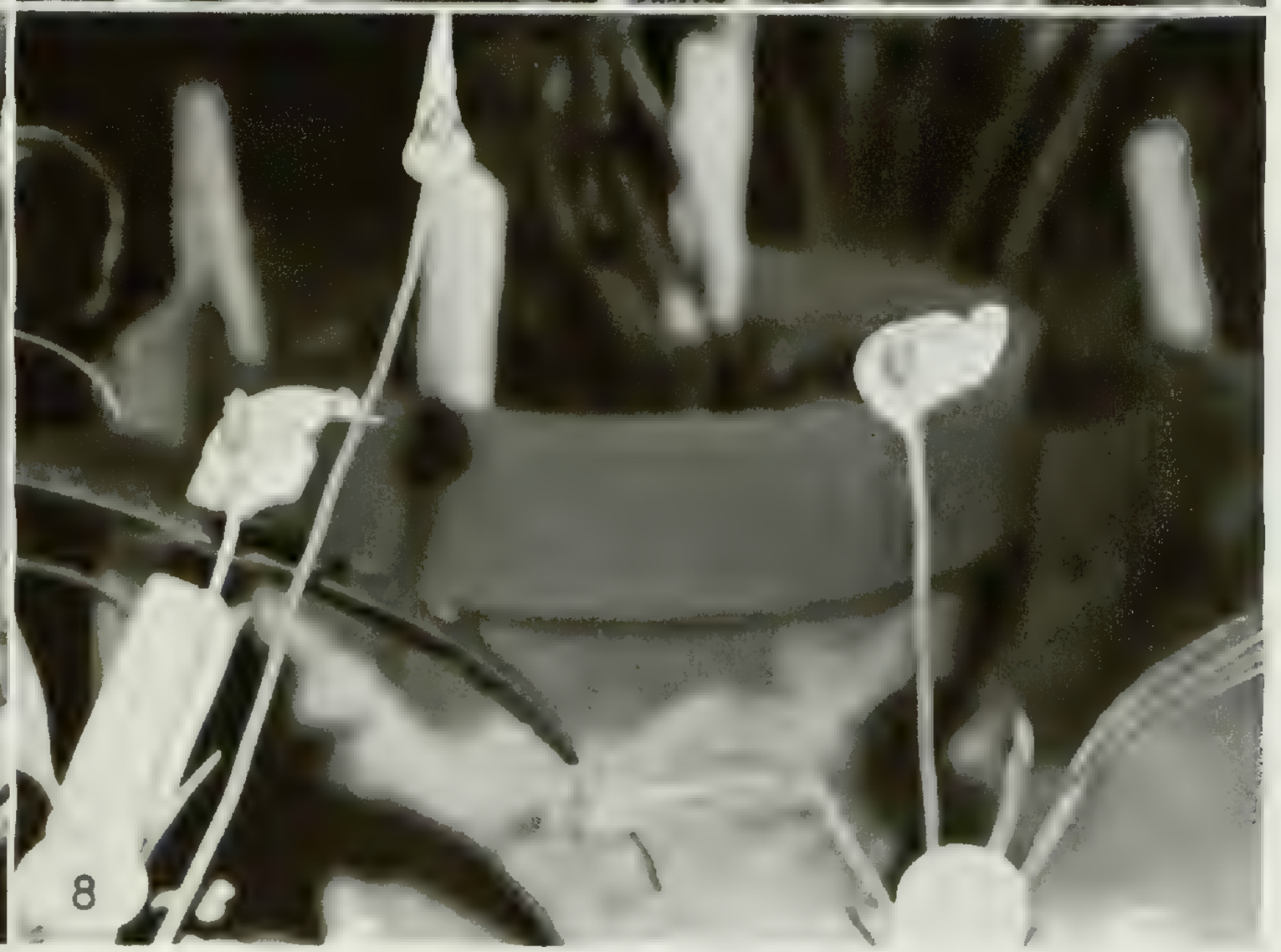
DARIÉN: top of Cerro Tacarcuna, *Gentry et al. 16902* (COL, MO, PMA), *Gentry & Mori 13993* (COL, MO, PMA).

Anthurium amnicola Dressler, Aroideana 3: 55. 1980. *Anthurium lilacinum* Dressler, Selbyana 2: 300. 10 Jan. 1979 (Dec. 1978), non Bunting, Dec. 1975. TYPE: Panama. Colón: along tributary between Caño Rey and San Lucas, S of Coclé del Norte, 19 Aug. 1972, on boulders, 1.5–2 m above river, *Dressler 4210* (US, holotype; MO, PMA, SEL, isotypes).

Epipetric; stems to 30 cm long, 4–6 mm diam.; roots few, less than 2 mm diam.; cataphylls very thin, 4–5 cm long, drying reddish brown, persisting intact. LEAVES erect-spreading; petioles 6–11 cm long, subterete, shallowly sulcate adaxially; geniculum 1–2 cm long, inconspicuous; blades subcoriaceous, semiglossy, elliptic to elliptic-lanceolate, gradually acuminate at apex, narrowly acute to rarely obtuse at base, 7–14.5 cm long, 1.2–3.7 cm wide, usually broadest near the middle; upper surface sparsely and inconspicuously glandular-punctate; lower surface epunctate; midrib acutely raised above and below, sunken toward apex above; basal veins 1–2 pairs, weakly sunken; primary lateral veins 3–4 per side, more or less obscure; collective vein arising from the first basal vein, 3–4 mm from the margin. INFLORESCENCE erect; peduncle terete, 6–26 cm long; spathe subcoriaceous, pale lavender (B & K Purple 6/5), ovate, 2.6–4.2 cm long, 1.5–2.2 cm wide, abruptly acuminate to cuspidate at apex, rounded to attenuate at base, inserted at 45° angle on peduncle; stipe 3–7 mm long; spadix violet purple, tapered toward apex, 0.8–2 cm long, 4–5 mm diam., flowers rhombic to more or less 4-lobed, 1.9–2.2 mm long, 3–3.2 mm wide, inner margins more or less straight; pistil weakly raised; stigma linear, ca. 0.4 mm long; lateral stamens emerging first, the alternates following slowly; anthers white, ca. 0.6–0.7 mm long, 1 mm wide, held at edge of tepals; pollen white. INFRUCTESCENCE with globose, whitish berries, 4–4.5 mm diam., mesocarp gelatinous; seeds 1–2, green, ovoid, slightly flattened, 2.5–3 mm long, 2–2.5 mm wide. Figs. 7 and 8.

Anthurium amnicola is endemic to Panama at 600 to 900 m in western Colón and Coclé Provinces in areas of premontane rain or tropical wet forest.

FIGURES 1–4 1. *Anthurium alticola* Croat, *Antonio 1513*.—2. *Anthurium angustilobum* Croat, *Mori & Kallunki 3462*.—3. *Anthurium antonioanum* Croat, *Croat 49819*.—4. *Anthurium antonioanum* Croat, *Croat 49819*.



FIGURES 5–8. 5, 6. *Anthurium antonioanum* Croat, *Croat 49819.*—7, 8. *Anthurium amnicola* Dressler, *Folsom 3155.*

The species is a member of section *Porphyrochitonium,* and as the specific epithet suggests it is found only on rocks in or along rapidly flowing mountain streams. It is distinguished by its small size, its narrowly oblong-elliptic, gradually acuminate leaves that dry pale and are only obscurely glandular-punctate, and especially by its narrowly to broadly ovate, pale lavender spathe and short, stubby, dark violet purple spadix and whitish berries. The species is unusual in being weakly glandular-punctate only on the upper surface. Even these punctations are not markedly apparent to the naked eye.

Anthurium amnicola is most closely related to *A. antioquiense* Engl. of northern Colombia, which has a similar habitat and habit and similar epunctate leaf blades. The latter species differs in having a white spathe and lavender spadix. *Anthurium amnicola* is not confused with any other species in Panama, although its habitat and leaf blades are similar to those of *A. sytsmae.* That species differs in having a green lanceolate spathe, a green spadix, and green fruits. *Anthurium rupicola* also occurs on rocks in streams in Coclé Province, but it differs in having a green, lanceolate spathe, white spadix, and violet purple berries.

COCLÉ: Alto Calvario, *Folsom 3155* (MO, RSA, SCZ), *5900* (MO); vicinity El Copé, *Antonio 3620* (MO, PMA), *Folsom 3265* (CAS, F, MO, SEL, US), *4941* (DUKE, GH, MO), *8280, 8637* (MO), *Folsom & Collins 6517* (MO, NY, PMA, RSA, SEL, US), *Hammel 809, 2366, 4116* (MO), *Maas et al. 2724* (MO, U); El Valle Market, near La Mesa, *Folsom 2664* (MO).

Anthurium angustilobum Croat, sp. nov. TYPE: Panama. Panamá: Gorgas Memorial Labs yellow fever research camp, ca. 25 km NE of Cerro Azul on Río Piedras, 550 m, near fork in river, *Mori & Kallunki 3462* (MO 2251828, holotype; K, PMA, isotypes).

Planta rupicola; cataphyllum persistens in fibris tenuibus; petiolus (9.5–)14–27 cm longus; lamina trilobata, lobis gracilibus posterioribus, subcoriacea, basi acuta, 10–20 cm longa, 15–19 cm lata; inflorescentia erecta; pedunculus 18–32 cm longus; spatha viridis, subcoriacea, lanceolata, 4–4.5 cm longa, 8–10 mm lata, stipite 4–10 mm longo; spadix 6–8 cm longus; baccae rubrae, obovoidae, 5.5–6 mm longae.

Growing among rocks; stems ca. 1.5 cm diam.; leaf scars obscured by cataphyll fibers; cataphylls 7–8 cm long, drying brown, weathering to fine, longitudinal fibers persisting around stem. LEAVES erect-spreading; petiole (9.5–)14–27 cm long, 2–3 mm diam.; geniculum ca. 1 cm long; blades subcoriaceous, 3-lobed, long-acuminate at apex; acute at base, 10–20 cm long, 15–19 cm wide, broadest at base; anterior lobe 10–20 cm long, posterior lobes 4–9 cm long; matte on both surfaces (dry); midrib raised above, more prominently raised below, basal veins 4–5 pairs, the first free to the base, those remaining coalesced 1–3.5 cm; primary lateral veins 3–6 per side, departing midrib at 20–25° angle, straight to collective vein, raised above and below; lesser veins prominulous above and below, collective vein arising from the first basal vein, loop-connecting the primary lateral veins in the median lobe, 3–4 mm from the margin. INFLORESCENCE usually erect; peduncle 18–32 cm long, ca. 3 mm diam.; spathe green, subcoriaceous, lanceolate, 4–4.5 cm long, 8–10 mm wide, broadest near the base, acuminate at apex, acute at base; stipe 4–10 mm long; spadix cylindroid-tapered, 6–8 cm long, 4–5 mm diam. at base, 2–3 mm diam. at apex (dry); flowers rhombic, 2–2.4 mm long, 1.5–1.7 mm wide, the sides straight to weakly sigmoid, 5–6 flowers in the principal spiral, 6–7 flowers in the alternate spiral; lateral tepals 0.5–0.7 mm wide; pistils scarcely emergent; stigmas linear; stamens emerging from the base, in a more or less prompt sequence, the alternate stamens preceding the third and fourth stamens by ca. 6 spirals; anthers held over pistil; thecae ovate, slightly divaricate. INFRUCTESCENCE erect or spreading, berries red, obovoid, 5.5–6 mm long, 4–5 mm diam., rounded at apex, mesocarp thickly gelatinous; seeds 1–2, 3.7–4.2 mm long, 2.8–3.5 mm wide, flattened when 2-seeded, enveloped in sticky substance extending beyond base and apex. Fig. 2.

Anthurium angustilobum is known only from the type locality in Panamá in an area of tropical wet forest at 550 m.

It is an apparent member of section *Semaeophyllium* and is distinguished by its thick, deeply three-lobed leaves with slender posterior lobes usually more than three times longer than broad and with the lowermost basal vein marginal to the sinus along most of its length. Also characteristic are the stipitate spadix and red berries.

The species appears not to be closely related to any other members of section *Semaeophyllium* and may be more closely related to certain members of section *Belolonchium* that have a tendency for well-developed lateral lobes. *Anthurium angustilobum* superficially resembles *A. seleri* Engl. from Mexico but that species differs

in that the dried leaf has more numerous veins spreading at a much broader angle from the midrib (mostly 40–60°). In contrast, those of *A. angustilobum* ascend at an angle of 20–25° from the midrib.

PANAMÁ: Gorgas Memorial Laboratory, NE of Cerro Azul on Río Piedras, *Mori & Kallunki 3462* (K, MO, PMA).

Anthurium angustispadix Croat & Baker, Brenesia 16(Supl. 1): 23. 1979. TYPE: Costa Rica. Puntarenas: primary forest along Río Coto Brus in the vicinity of Las Alturas, 23 km N of La Unión (on Panamanian border), ca. 1,500 m, *Croat 26600* (MO 2251852, holotype; B, BR, CR, F, K, NY, PMA, SEL, US, isotypes; Live at MO).

Epiphyte, sometimes terrestrial; stems 18–30 cm long; cataphylls persisting; petioles 5–22 cm long, 4–7.5 mm diam., narrowly sulcate and grooved in the sulcus, rounded abaxially; blades lanceolate to oblong-lanceolate, thin to medium thick, acute to attenuate at base, 13–30 cm long, 4–7.5 cm wide. Inflorescence erect-spreading, peduncles 20–40 cm long, 1.5–3 mm diam., terete; spathe medium green, linear-lanceolate, 4.5–8.5 cm long, 4–9 mm wide; spadix stipitate to 3 mm or sessile, greenish yellow at base, paler at apex, 4.5–10 cm long, 3–6 mm diam. at base; berries pale yellow-green, obovoid to depressed globose, almost flat at apex, to 5 mm long. See Croat (1983: 249) for a more complete description.

Anthurium angustispadix is known from eastern Costa Rica and western Panama at elevations from 100 to 1,500 m in premontane wet and tropical wet forest life zones.

The species is perhaps best placed in section *Xialophyllium* and is recognized by its slender elongate stems with weathered, tan cataphylls, its lanceolate leaves, its greenish yellow, long slender spadix, and its pale yellow-green berries. It is not easily confused with any other species.

CHIRIQUÍ: NW side of Cerro Pando, *Croat 15958* (MO); road to Gariché, *Folsom et al. 7188* (MO); between Gualaca & Fortuna Dam site, N of Gualaca, *Croat 48792, 48812* (MO); between Gualaca & Fortuna Dam site, NW of Los Planes de Hornito, *Croat 50105* (MO); Las Lagunas near Volcán, *Page 125, 126* (MO); vicinity Los Planes de Hornito, *Croat 48851* (MO); along Río Chevo, *Knapp 1567* (K, MO); W of Río Chiriquí Viejo, *D'Arcy 10840* (MO); 7.5 mi. from bridge over Río Chiriquí Viejo, *Hammel et al. 6860* (CAS, MO).

Anthurium antonioanum Croat, sp. nov. TYPE: Panama. Chiriquí: along road between Gualaca and Fortuna Dam site, 10 mi. NW of Los Planes de Hornito, ca. 8°42′N, 82°18′W, 1,260 m, *Croat 50059* (MO 2739735, 2769051, 2769053, holotype; COL, K, NY, PMA, SEL, US, isotypes; Live at MO).

Planta epiphytica; caudex 30–150 cm longum; cataphyllum subcoriaceum persistens in reticulum fibrarum grossarum; petiolus teres ad subteres, 55.5–95 cm longus; lamina subcoriacea, late ovata, basi profunde cordata, 48–92 cm longa, 32–68 cm lata; inflorescentia effusa; pedunculus teres, 11–15 cm longus; spatha subcoriaceae, viridis tinctus rubra-purpurea, ovata, 15–19 cm longa, 3–7.5 cm lata, interdum cucullo super spadecem; stipes 1.5 cm longum; spadix rubro-purpureum ad purpureum, 7–17 cm longum; baccae ignotae.

Epiphyte; stems 30–150 cm long, 3.5–8 cm diam., internodes short, leaf scars conspicuous; roots to 8 mm diam., cataphylls subcoriaceous, 15–25 cm long, drying dark reddish brown, weathering to coarse, reticulate fibers. LEAVES with petioles erect-spreading, 55.5–95 cm long, 1–1.5 cm diam., terete to subterete; geniculum 3–4.5 cm long, markedly thicker than petiole, narrowly sulcate; blades subcoriaceous, broadly ovate, acuminate at apex, deeply lobed at base, 48–92 cm long, 32–68 cm wide, broadest at point of petiole attachment, the margins conspicuously undulate; anterior lobe 38–64 cm long, the margins rounded, posterior lobes 15–28 cm long (from apex of sinus to outermost point); sinus broadly hippocrepiform, rounded at apex; both surfaces semiglossy, the lower surface much paler; midrib raised above and below (dry); basal veins 6–8 pairs, the first sometimes free to the base, those remaining coalesced 2–15 cm, paler than surface above, raised above and below (dry), posterior rib naked, the outer margin turned up; primary lateral veins 4–6 per side, departing midrib at 40–45° angle, weakly arching near collective vein, raised above and below (dry), lesser veins conspicuous on drying; collective vein arising from the first or second basal vein, sometimes from one of the primary lateral veins near the middle of the blade. INFLORESCENCE spreading, shorter than leaves; peduncle 11–15 cm long, 4–7 mm diam., terete; spathe moderately thick, green tinged red-violet, ovate, 15–19 cm long, 3–7.5 cm wide, broadest just above base, held erect, sometimes hooding spadix, cuspidate at apex, acute at base; stipe ca. 1.5 cm long, spadix

red-violet to violet purple, 7–17 cm long, 1.8–2.5 cm diam. near base, 8–11 mm diam. near apex; flowers rhombic, 1.5–2 mm in both directions, the sides jaggedly sigmoid, 9–12 flowers visible in the principal spiral, 11–13 flowers visible in the alternate spiral; tepals matte, lateral tepals 0.7–0.9 mm wide, the inner margin more or less straight (dry); pistils emergent, green; stamens emerging scattered throughout length, prominently exserted; anthers yellow-brown, held over pistil; pollen yellow. INFRUCTESCENCE not seen. Figs. 3, 4, 5, and 6.

Anthurium antonioanum is known only from Panama in Chiriquí along the Fortuna Dam Road and in Darién on Cerro Pirre; it is expected, however, in Colombia on the Serranía de Pirre. It has been collected in premontane rain and lower montane rain forest life zones at 1,000 to 1,400 m.

The species is a member of section *Belolonchium* and is distinguished by its large stems, its large dangling roots, its large ovate-cordate leaves that are sometimes about as broad as long, its stout, short-pedunculate inflorescence, and its relatively stubby, violet purple spadix with prominently exserted stamens.

Anthurium antonioanum is named in honor of Dr. Thomas Antonio who provided us with many live aroid collections during his tenure as curator of Summit Herbarium. It is not related to or confused with any Central American species; its affinities lie with several South American species, especially *A. gualeanum* Engl. of Ecuador that differs in occurring at higher elevations and in having the spathe held nearly closed over the spadix at anthesis.

CHIRIQUÍ: along road to Fortuna Dam site, *Croat 48735* (MO, PMA, US); between Gualaca & Fortuna Dam site, NW of Los Planes de Hornito, *Antonio 4201* (MO), *Croat 49819* (CR, DUKE, F, MO, NY, PMA, US), *49840* (MO, NY, PMA, SEL, US), *50059* (COL, K, MO, NY, PMA, SEL, US).

DARIÉN: summit of Cerro Pirre, *Gentry & Clewell 6994* (MO).

Anthurium bakeri Hook. f., Bot. Mag. 52: pl. 6261. 1876. TYPE: Costa Rica. *Bull s.n.* (K).

Anthurium turrialbense Engl., Bot. Jahrb. Syst. 25: 406. 1898. TYPE: Costa Rica. Cartago: Turrialba, 500 m, *Donnell-Smith 4978* (B).

Epiphyte, stems less than 10 cm long, 1.5 cm diam.; cataphylls drying brown, persisting as fibers; petioles (3–)11–19 cm long, to 5 mm diam., subterete to sharply sulcate; blades narrowly elliptic-lanceolate to narrowly oblanceolate, 19–55 cm long, 2.8–9 cm wide, narrowly rounded at base; lower surface with reddish brown punctations. Inflorescence erect-spreading; peduncle 5.5–30 cm long, 3–5 mm diam.; spathe coriaceous, pale yellow-green, the edges sometimes tinged with purple, 2–5.5 cm long, 7–28 mm wide, oblong-lanceolate; stipe 3 mm long, 2 mm diam.; spadix creamy white, 2–11 cm long, 5–15 mm diam. at base; berries red, pointed at apex, obovoid, ca. 6 mm long; seeds 2. See Croat (1983: 252) for a more complete description.

The species is known from Guatemala to Colombia in wetter parts of tropical moist, premontane wet, and tropical wet forest at elevations from sea level to 660 m. In Panama, the species ranges to 1,000 m. In Colombia it is known from a single collection from Norte de Santander (Camp 84 on Pipeline, 600 m) by *Foster & Foster 1716* (A).

Anthurium bakeri can be distinguished by its moderately thin, elliptic-lanceolate blades that are reddish brown punctate on the lower surface and have many weak primary lateral veins and conspicuously sunken collective veins. The lower leaf surface usually dries much paler than upper surface, sometimes yellowish, contrasting sharply with the green upper surface. Other distinguishing features include the creamy white, almost cylindrical spadix and bright red berries. The species is a member of section *Porphyrochitonium.*

BOCAS DEL TORO: vicinity Chiriquí Lagoon, *Wedel 2857* (MO).

CANAL ZONE: Barro Colorado Island, *Bailey & Bailey 626* (BH), *Croat 6627* (B, K, MO, NY, RSA, VEN), *8034, 10882, 15008A* (MO), *Foster 1121, 1781* (DUKE), *Shattuck 917* (MO); Summit Garden, *Croat 17144* (MO).

COCLÉ: Alto Calvario, *Folsom 5816* (MO); Cerro Pilón, *Dwyer et al. 4522* (MO); El Valle de Antón, *Kennedy et al. 3184* (MO); N of El Valle de Antón, *Luteyn 1153* (DUKE), *Luteyn & Kennedy 1609* (DUKE); La Mesa, above El Valle de Antón, *Croat 25369, 37317* (MO), *Folsom & Raul 5642* (MO), *Hammel 3903* (MO), *Luteyn 4075* (DUKE), *Sullivan 461* (MO), *Sytsma et al. 4344* (MO); N of Llano Grande on road to Coclecito, *Antonio 3573* (MO), *Hammel 1929, 1932* (MO), *Sytsma et al. 4397* (MO); N of Penonomé, *Hammel 4013, 7198* (MO).

COLÓN: S approach to Cerro Bruja from Río Escandaloso, *Hammel 3206* (MO), *Kress & Knapp 88-1404* (DUKE); NE of Puerto Pilón, *Nee & Tyson 10897* (MO); between Río Piedras & Río Gatún, SW of Cerro Bruja, *Sytsma et al. 4302, 4305* (MO); along Río

Guanche, *Croat 26199, 36950* (MO), *Hammel et al. 4910* (MO), *Mori & Witherspoon 7968* (MO); on Santa Rita Ridge Road, *Antonio 3894* (MO), *Croat 13208A, 34344* (MO), *Folsom 3689* (MO), *Hammel 3662* (MO), *Sytsma 1573* (MO), *Witherspoon et al. 8326* (MO).

DARIÉN: trail from Cana to Colombian border along Río Setegantí, *Gentry et al. 28578* (MO); NE slope of Cerro Sapo, *Hammel 7235* (MO); on trail from Punta Guayabo Grando to Río Jaqué, *Antonio & Hahn 4404* (MO); vicinity Tyler Kittredge mining camp, *Croat 27131* (MO), *27203* (MO, PMA).

PANAMÁ: Campo Tres, NE of Altos de Pacora, *Liesner 566* (MO); vicinity Cerro Jefe, *Croat 35916* (MO), *Sheffer 158* (MO); between Cerro Jefe & La Eneida, *Luteyn & Foster 1135* (DUKE); El Llano-Cartí Road, *Croat 33762* (CAS, MO), *49107* (MO), *Folsom & Collins 1513* (MO, PMA), *Folsom 5791* (MO), *Hammel 7335* (MO), *Kennedy et al. 2406, 2494* (MO), *Kennedy 2719* (MO), *Kennedy & Dressler 2926* (MO), *Knapp 1357* (MO), *Liesner 1157* (MO), *Maas et al. 2820* (MO), *Mori et al. 4127* (MO).

SAN BLAS: Puerto Obaldía, *Pittier 4414* (US).

VERAGUAS: vicinity Santa Fe, *Croat 23002, 49072* (MO), *Mori et al. 6679* (MO, PMA), *Nee 11164* (MO).

Anthurium barryi Croat, sp. nov. TYPE: Panama. Darién: Cerro Sapo, *Hammel 7258* (MO 2822901, holotype; B, K, PMA, US, VEN, isotypes; Live at MO).

Planta epiphytica; petiolous subteres, sulcatus, 12–23 cm longus; lamina elliptica ad anguste ovata, subcoriacea, basi acuta ad obtusa, 10.5–18.5 cm longa, 6–9.2 cm lata; pagina inferiore glanduloso-punctata; inflorescentia effusa; pedunculus teres, 12–26 cm longus; spatha luteo-viridis, anguste lanceolata, 2.5–4 cm longa, 0.6–1.3 cm lata; stipite 1–2.5 cm longo; spadix luteo-viridis, 3–6.8 cm longus; baccae lilicinae.

Epiphyte; stems short, ca. 1.5 cm diam.; leaf scars obscured by roots and cataphylls; roots green, moderately thin, descending; cataphylls moderately thin, 3–4.7 cm long, rounded at apex, minutely apiculate, drying medium brown (B & K Yellow 6/5), weathering to reticulate fibers at base, persisting intact at apex. LEAVES erect-spreading; petioles 12–23 cm long, 3–4 mm diam., subterete, shallowly sulcate, the margins sharp; geniculum 2–2.5 cm long, scarcely thicker and paler than petiole; blades elliptic to narrowly ovate, subcoriaceous, abruptly to gradually acuminate at apex, acute to obtuse at base, 10.5–18.5 cm long, 6–9.2 cm wide, broadest at middle or just below; both surfaces semiglossy, the upper surface medium green, eglandular, the lower surface slightly paler, densely glandular-punctate; midrib acutely raised above, sunken at apex, convexly raised below; primary lateral veins 10–12 per side, departing midrib at 40° angle, sunken, giving blade a more or less bullate appearance particularly in older leaves, raised below, running straight to collective vein; interprimary veins sunken above, more or less obscure below; lesser veins obscure; collective vein arising from base, 3–5 mm from margin, forming an acute angle with margin near apex, sunken above, raised below. INFLORESCENCE spreading, equalling or shorter than leaves; peduncle terete, 12–26 cm long, 2–4 mm diam.; spathe moderately thin, yellow-green (B & K Yellow-green 6/7.5), narrowly lanceolate, 2.5–4 cm long, 0.6–1.3 cm wide, broadest near base, gradually acuminate at apex, acute at base inserted at 45° angle on peduncle, erect-spreading; stipe 1–2.5 cm long, becoming elongate after spathe opens; spadix yellow-green (B & K Green 6/2.5), 3–6.8 cm long, 4–5 mm diam. near base, ca. 2 mm diam. at apex; flowers rhombic to sub-4-lobed, 2.7–3 mm long, 2.5–3 mm wide, the sides sigmoid; 3–5 flowers visible in the principal spiral and 5–6 flowers visible in the alternate spiral; tepals semiglossy, densely papillate, lateral tepals 1.3–1.5 mm wide, the inner margin straight to weakly convex; pistils pale green, weakly emergent or emergent to ca. 1 mm in larger plants; stigma linear, exserted, brush-like; stamens emerging in a complete sequence from base, laterals first, followed quickly by alternates, the laterals emerging 2–3 spirals ahead of alternates, exserted on short, broad, translucent filaments ca. 0.4 mm long, ca. 0.5 mm wide, retracting to hold anthers at edge of tepals (held at sides of pistil when pistils are more emergent), persisting against sides of pistils, not contiguous; anthers ca. 0.3 mm long, 0.5 mm wide; thecae ovate, not divaricate; pollen white. INFRUCTESCENCE spreading; berries pale lavender, globose, depressed at apex, 0.8–1 cm long, 1–1.1 cm diam., mesocarp pulpy, white; 5–6 seeds, green, 2.5–3.2 mm long, 2.3–2.5 mm wide, brown at apex with short appendage. Figs. 23 and 24.

Anthurium barryi is endemic to Panama in the Serranía del Sapo in southwestern Darién Province at about 1,000 m in premontane rain forest.

The species, a member of section *Porphyrochitonium,* is distinguished by its small size, its epiphytic habit, its short, slender stem with persistent cataphylls, its sulcate petioles almost equalling to greatly exceeding the length of the blade, and by its elliptic to ovate-elliptic, glandular-punctate blades. It is also especially distinguished by its long-pedunculate inflorescence equalling or exceeding the leaves with an unusu-

ally long, stipitate, green to yellow spadix and green or pink to purplish, narrowly lanceolate spathe. In more mature plants the pistils may be emergent up to about 1 mm whereas in smaller plants the pistil is scarcely emergent before stamens appear. In extreme cases the stipe may almost equal the length of the spadix. In living plants the blades are arched along their midribs with etched primary lateral and collective veins.

The species is named in honor of Barry Hammel who was the first collector to climb Cerro Sapo while he worked for the Missouri Botanical Garden in Panama during 1979. It is not close to any other described species in the section, although it superficially looks like *Anthurium umbricolum* Engl. from Ecuador that differs in lacking dark glandular punctations on the blades.

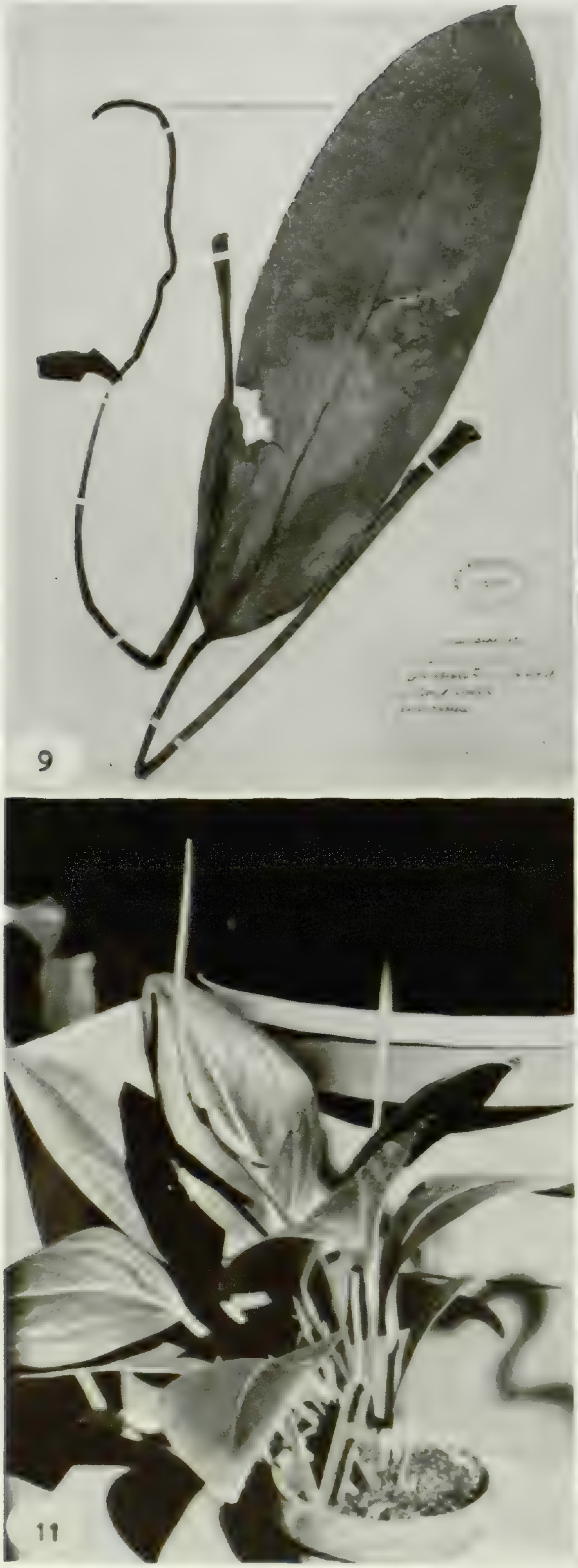
DARIÉN: Cerro Sapo, *Hammel 1162* (MO, PMA), *1163, 1164, 1165* (MO), *7258* (B, K, MO, PMA, US, VEN).

Anthurium bicollectivum Croat, sp. nov. TYPE: Panama. Panamá: middle slopes of Cerro Campana, ca. 1 mi. from Pan-American Hwy., ca. 150 m, *Croat 35943* (MO 2388982, holotype; CAS, K, NY, PMA, US, isotypes; Live at MO).

Planta epiphytica; cataphyllum persistens reticulum fibrasum; petiolus (2–)9–17(–23) cm longus, subteres, late sulcatus, conspicue glanduloso-punctatus; lamina elliptica ad oblongo-elliptica, coriacea, apice abrupte brevi-acuminata, basi acuta ad obtusa, (5–)16–25(–30) cm longa, (3–)8–10(–13.5) cm lata, utrinque glanduloso-punctata; inflorescentia erecta et effusa; pedunculus teres, (9–)17–34(–46) cm longus; spatha subcoriacea, viridis pallide, lanceolata ad oblongo-lanceolata, 4–9 cm longa, 1.5–2.5 cm lata; spadix luteo-viridis, (5–)9–20(–23) cm longus; baccae subglobosae, luteo-aurantiacae; semina 1–4.

Epiphyte; stems less than 20 cm long, 1–2 cm diam.; leaf scars and internodes hidden by cataphylls; roots moderately few, thin, green; cataphylls moderately thin, 4–6 cm long, rounded at apex (the acumen apiculate), drying brown, weathering to persistent, reticulate fibers. LEAVES erect to spreading; petioles (2–)9–17(–23) cm long, 5–7 mm diam., subterete, broadly and sharply sulcate, conspicuously dark glandular-punctate on surface; geniculum 1–3 cm long; blades elliptic to oblong-elliptic, coriaceous, abruptly short-acuminate at apex (the acumen downturned, the blade sometimes conspicuously arching), acute to obtuse at base, (5–)16–25(–30) cm long; (3–)8–10(–13.5) cm wide, broadest at middle or in lower half, usually revolute near the margins; upper surface matte to semiglossy, lower surface matte, both surfaces dark glandular-punctate; midrib convexly raised above, narrowing and sunken at apex, convexly raised below; primary lateral veins 7–10(–20) per side, departing midrib at 30–50° angle, scarcely raised above, shallowly sunken below; interprimary veins scarcely less prominent than primary lateral veins (drying equally conspicuous); basal veins 2 or 3, the first forming a collective vein 1–2 cm from the margin, the second extending to the apex 6 mm or less from the margin or merging with margin usually at middle or above, the third when present merging with margin in the lower one-fourth of blade. INFLORESCENCE erect to spreading; peduncle (9–)17–34(–46) cm long, 3–6 mm diam., terete; spathe moderately thick, pale green, lanceolate to oblong-lanceolate, 4–9 cm long, 1.5–2.5 cm wide, broadest in the basal third, abruptly acuminate at apex, obtuse at base, obliquely attached and decurrent 0.5–1 cm on peduncle, inserted at 50–60° angle on peduncle, usually strongly reflexed, held parallel to peduncle; spadix yellow-green (B & K Yellow-green 7/7.5), tapered toward apex, (5–)9–20(–23) cm long, 5–7 mm diam. at base, 3–4 mm diam. at apex; flowers rhombic, 3–5 mm long, 2.7–4 mm wide, the sides sigmoid, 5–6 flowers visible in the principal spiral, 7–8 visible in the alternate spiral; tepals matte, lateral tepals 1–1.5 mm wide, the inner margins straight to concave; pistils weakly raised, darker green than tepals; stigmas weakly exserted, with minute droplet for ca. 1 week; stamens emerging in a regular sequence beginning at base, laterals first, followed by alternates, laterals completely retracting as alternates emerge, usually 2 (rarely 3) visible at any time, ultimately retracted throughout; anthers flat, 0.3–0.6 mm long, 0.7–0.11 mm wide; thecae more or less translucent; pollen scarce, pale yellow, fading to white. INFRUCTESCENCE spreading to pendent; berries subglobose, yellow-orange (B & K Yellow-red 8/7.5), rounded to truncate at apex; mesocarp gelatinous with numerous, minute raphide cells; seeds 1–4, greenish white, 2.1–2.6 mm long, 1.5–1.9 mm wide, 1–1.3 mm thick, the appendages slender, attached at both ends. Figs. 11, 13, and 14.

Anthurium bicollectivum is endemic to Panama but is to be expected in northern Colombia in the Department of Chocó. It ranges from 200 to 1,000 m and occurs in premontane wet, tropical wet, and premontane rain forest. It is known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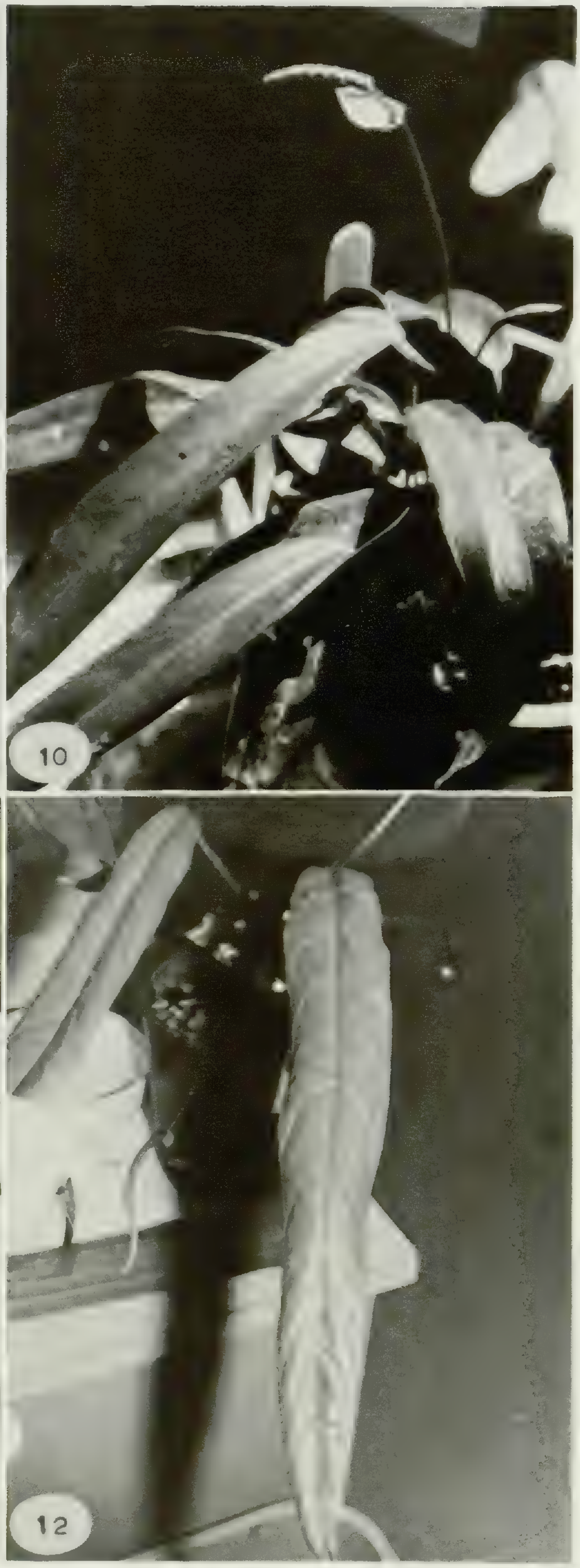
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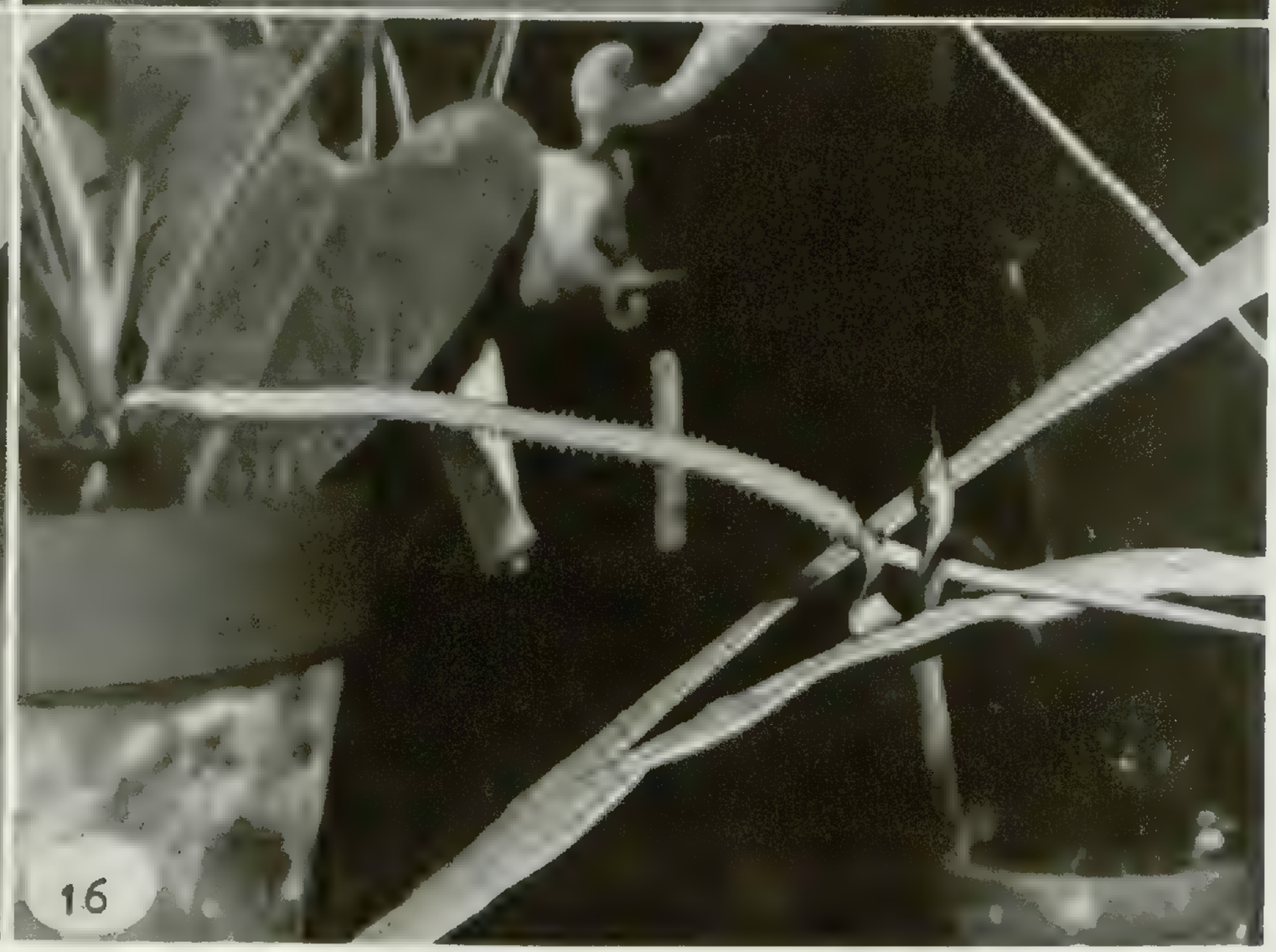
FIGURES 9–12. 9. *Anthurium chiriquense* Standl., *Davidson 283.*—10. *Anthurium brevispadix* Croat, *Croat 44546.*—11. *Anthurium bicollectivum* Croat, *Croat 35993.*—12. *Anthurium cerropirrense* Croat, *Croat 37857.*



FIGURES 13–16. 13. *Anthurium bicollectivum* Croat, *Croat 37561*.—14. *Anthurium bicollectivum* Croat, *Croat 35993*.—15, 16. *Anthurium cerropirrense* Croat, *Croat 37857*.

principally from central Panama in Veraguas, Colón, Coclé, and Panamá Provinces with an outlying collection in the Central Cordillera in Darién Province, but it is unknown from the Serranía de Darién.

The species, a member of section *Porphyrochitonium,* is perhaps the most variable species of this section. Blade shape varies from lanceolate with acute apices to broadly obovate or elliptic with rounded, minutely cuspidate apices. Also variable is the disposition of the inflorescence (sometimes with a stiffly erect peduncle or sometimes with the peduncle more slender and flexible).

The species is distinguished by the presence of two pairs of collective veins (thus the name *bicollectivum*) along each margin. The second collective vein (antemarginal collective) usually extends all the way to the apex and a third pair is sometimes present, usually joining the margin in the lower fourth of the blade. Other distinguishing features include coriaceous, glandular-punctate leaves with petioles usually much shorter than the blades, green or yellow-green spadix, green spathe (turning yellow to orange in age), and yellow-orange to orange berries.

CANAL ZONE: no other location, *Mason 56, 58* (K); road between Gatún & Piña, *Croat 36936A* (MO).

CHIRIQUÍ: Cerro Colorado, *Croat 33401* (MO).

COCLÉ: Alto Calvario, *Folsom 3141, 3194, 3195* (MO); vicinity Cerro Pilón, *Croat 37561* (MO, PMA), *Porter et al. 4391, 4448* (MO); vicinity El Copé, *Antonio 1166, 3255* (MO), *Hammel 6283* (MO); vicinity El Valle, *Allen 1843* (F, MO), *3563* (MO), *Folsom 3120* (MO), *Kennedy et al. 3194, 3214* (MO), *Sytsma 4038* (MO); vicinity La Mesa, *Croat 37348* (B, MO), *Folsom 2789* (MO), *Hammel 3901* (MO), *Luteyn 3170, 3171* (DUKE).

COLÓN: Río Guanche, *Antonio 4801* (MO); Santa Rita Ridge, *Kennedy et al. 1122* (DUKE, F).

DARIÉN: headwaters of Río Tuquesa, *Croat 27107* (MO).

PANAMÁ: Cerro Campana, *Allen 2662* (F), *Croat 14481A, 14772, 17198, 25205* (MO), *35943* (CAS, K, MO, NY, PMA, US), *Dwyer et al. 4836* (MO), *Ebinger 350* (MO, US), *Folsom et al. 2298* (MO), *Foster & Kennedy 2069* (DUKE), *Kamemoto 231* (MO), *Kennedy et al. 2070* (MO), *Liesner 604A* (US), *Luteyn 1044, 3185* (DUKE), *Luteyn & Kennedy 1791* (DUKE), *Porter et al. 4276, 4957* (MO), *Stimson 5406* (NY); Cerro Jefe, *Correa et al. 1618* (MO, PMA), *Croat 45027, 45029, 45030, 45064* (MO), *Maas et al. 2703* (MO, U), *Sheffer 152, 167* (MO), *Witherspoon 8591* (MO); El Llano-Cartí Road, *Croat 22881, 49130* (MO), *D'Arcy 10630* (F, MO), *Gentry 5807* (MO), *Hammel 7333* (MO), *Kennedy 2557* (MO), *Kennedy & Dressler 2931, 2957* (MO), *Kennedy et al. 3151* (MO), 3408 (US), *Liesner 663* (F, MO, US), *1159* (MO), *Mori & Kallunki 5567* (K, MO, PMA), *Mori 7746* (MO).

VERAGUAS: vicinity Santa Fe, *D'Arcy 10327* (MO), *Liesner 1025* (MO), *Nee 11256* (MO), *Witherspoon & Dressler 8888* (MO).

Anthurium brevispadix Croat, sp. nov. TYPE: Panama. Coclé: along road above El Copé on Continental Divide, 5.2 mi. N of El Copé, 900–950 m, 1.5 mi. N of sawmill, 8°39′N, 80°36′30″W, *Croat 44546* (MO 2806658, holotype; K, PMA, US, VEN, isotypes; Live at MO).

Planta epiphytica; caudex ca. 10 cm longus; cataphyllum persistens fibris tenuibus; petiolus teres, 4.5–8.5 cm longus; lamina subcoriacea, linearis, basi acuta ad obtusa, (6–)11–20 cm longa, (1.5–)2–2.8 cm lata, utrinque glanduloso-punctata; inflorescentia erecta; pedunculus 10–13.5 cm longus, teres; spatha membranacea, pallide viridis, anguste ovata, 1.4–2 cm longa; spadix pallide viridis; 1.6–2.5 cm longus; baccae ignotae.

Epiphyte; stems ca. 10 cm long, 7 mm diam.; leaf scars covered by persistent cataphylls; roots pale green, 2.5–3 mm diam.; cataphylls moderately thin, 2.3–2.7 cm long, acuminate at apex with a subapical apiculum 3 mm long, drying tan (B & K Yellow 6/7.5), weathering to fine persistent fibers. LEAVES with petioles erect-spreading, terete, 4.5–8.5 cm long, ca. 1.5 mm diam.; geniculum 7–12 mm long, weakly sulcate; blades subcoriaceous, linear, gradually acuminate at apex (the acumen flat), acute to obtuse at base, (6–)11–20 cm long, (1.5–)2–2.8 cm wide, broadest near middle, the margins markedly revolute; both surfaces semiglossy and glandular-punctate, the glands sparse and more or less obscure on upper surface, the epidermis weakly papillate; lower surface slightly paler with the glands dense and reddish brown; midrib weakly raised at base above, flat midway, weakly sunken near apex; weakly raised below, broader at base, narrow and acute toward apex; primary lateral veins 5–7 per side, departing midrib at 30–35° angle, obscure above, flat, darker than surface below; interprimary veins scarcely visible below; collective vein arising from the base, not apparent above, slightly darker than surface below, 1–3 mm from margin. INFLORESCENCE erect, shorter than leaves; peduncle 10–13.5 cm long, ca. 2 mm diam., terete, 2–3 times longer than petioles; spathe thin, pale green, narrowly ovate, 1.4–2 cm long; spadix pale green (B & K Yellow-green 6/10), only slightly tapered, rounded at apex, 1.6–

2.5 cm long, 3–3.5 mm diam. midway; flowers rhombic, 2.2–2.4 mm long, 1.8–2 mm wide, the sides straight to sigmoid, 3–4 flowers visible in the principal spiral, 6–7 flowers visible in the alternate spiral; tepals matte, minutely papillate; lateral tepals 1.1–1.3 mm wide, the inner margin broadly rounded to more or less straight; pistil slightly raised, green; stigma oblong-elliptic, ca. 0.3 mm long, weakly exserted, brush-like; stamens emerging in a prompt complete sequence from the base, leading spiral preceding the completed flowers by ca. 6 spirals, the first lateral to two-thirds the length of the spadix (preceding second lateral by 3 spirals) while the completed spirals are present in the lower one-fourth of the spadix; anthers white, ca. 0.2 mm long, 0.4 mm wide; thecae ovate, slightly divaricate; pollen white. INFRUCTESCENCE not seen. Fig. 10.

Anthurium brevispadix is endemic to Panama in Coclé Province near El Copé at 900 to 950 m in premontane rain forest, and it is known only from two collections.

The species, a member of section *Porphyrochitonium,* has leaves nearly identical to those of *Anthurium friedrichsthalii,* but they are much smaller, usually less than half as long. *Anthurium brevispadix* differs in having a radically different inflorescence with a long stipitate (stipe one-sixth to more than one-half as long as spadix at anthesis) yellowish green spadix with only three to four flowers visible from any angle in its principal spiral and with stamens that remain exserted after anthesis. In contrast, *A. friedrichsthalii* has a consistently sessile, generally much longer spadix (when fully developed) that has at least five flowers visible per spiral from any angle and stamens that are consistently retracted from view beneath the tepals after being briefly exposed.

Anthurium brevispadix (so named because of its short spadix) may be confused with *A. redolens,* which also has a similarly shaped leaf with the collective veins more prominently sunken than the primary lateral veins. That species differs in having a spadix that is pale lavender or creamy white becoming lavender soon after anthesis and later purplish (see that species for additional comments).

Anthurium curvilaminum also has a collective vein more prominent than the primary lateral veins, but it has a much thicker blade and also has a purplish spadix.

COCLÉ: N of El Copé, *Croat 44546* (K, MO, PMA, US, VEN), *Maas et al. 2763* (U).

Anthurium brownii Mast., Gard. Chron. 6: 744, figs. 139, 140. 1876. TYPE: Colombia (Nueva Granada). *Wallis s.n.* (K).

Epiphyte; stems short, to 2.5–3(–5) cm diam.; cataphylls drying reddish brown persisting more or less intact, ultimately weathering to a network of fibers at base; petioles 13–100 cm long, 3–10 mm diam., subterete, shallowly and bluntly sulcate; blades narrowly ovate-triangular, moderately thick, 15–66 cm long, 11–48 cm wide, prominently lobed at base. Inflorescence erect; peduncle 51–65(–76) cm long, 4–6(–9) mm diam.; spathe lanceolate, green, 8–23 cm long, 1.5–4.5 (–6) cm wide; spadix stipitate to ca. 11 cm, 7–28 cm long, 4–15 mm diam., violet purple; berries orange to red-orange, ellipsoid to obovoid, 5–8 mm long., ca. 5 mm diam., seeds 2. See Croat (1983: 260) for a more complete description.

The species is known from Costa Rica to Colombia at elevations from near sea level to 1,200 m. In Panama it also occurs rarely in premontane moist and tropical moist forest.

Anthurium brownii is in section *Belolonchium* and is distinguished by its thick blades with usually undulate margins and reticulate veins that dry very prominent. The leaf tends to dry silver or grayish on both surfaces. Also distinctive are the long, slender, violet purple spadix and the red-orange berries.

Three collections from the Río Tuquesa area in Darién Province, *Croat 27147, 27166, 27197,* match the type of *Anthurium brownii* from Colombia but differ from material from Barro Colorado Island in having a longer anterior lobe.

CANAL ZONE: Barro Colorado Island, *Croat 4064, 5393, 5422, 6303, 6338, 7352, 8252, 10389, 11669, 15047* (MO), *5280* (C, GH, MEXU, MO), *7910* (MO, PMA), *Foster 286, 1935* (DUKE), *Shattuck 597* (MO); vicinity Coco Solo, *Stimson 5265* (DUKE); S of Fort Sherman, *Nee & Tyson 10890* (MO); Gatún, *Hayes 438* (NY); Orchid Garden, Ancon Hill, *Bartlett & Lasser 16616* (MICH, MO); Pipeline Road near Río Agua Salud, *Kennedy & Young 1820* (MO); Pipeline Road N of Gamboa, *Luteyn & Foster 1548* (DUKE); Río Indio de Gatún, *Pittier 2779* (NY); Summit Gardens, *Bartlett & Lasser 16810* (MICH, MO), *Croat 11692* (MO).

COCLÉ: on road to Cascajal W of Continental Divide, *Sytsma et al. 4409* (MO); vicinity El Valle, *Alston & Allen 1844* (MO), *Folsom 3126* (MO); La Mesa, *Croat 37414* (MO).

COLÓN: road from Colón to Portobelo, *Folsom 3756* (MO); along ocean W of Portobelo, *Croat 33579* (C, DUKE, M, MO, S, UC, US, W); road to Mosquera from Palmas Bellas, *Mori & Kallunki 1973* (MO); road from Portobelo to Nombre de Dios, *Croat 33564* (CAS, CM, COL, DUKE, F, MO, PMA, US), *33635* (MO); Puerto Pilón-Portobelo Road, *Nee 6699* (MO); Río Guanche above bridge on Portobelo Road, *Croat 36973, 37004* (MO); Santa Rita Ridge Road, *Cowell 100* (NY), *Croat 34311* (MO, US), *Mori & Kallunki 2156* (MO).

DARIÉN: Cerro Sapo, *Hammel 1285* (MO); Río Morti, *Duke 14126* (MO); headwaters of Río Tuquesa, *Croat 27166* (F, MO), *27147, 27197* (MO); Serranía de Pirre, *Croat 37796, 37824* (MO), *37840* (B, K, MO, NY, RSA, VEN).

PANAMÁ: Altos de Pacora, *Lewis et al. 2337* (MO); vicinity Arenoso, *Seibert 598* (MO); Cerro Campana, *Croat 35954* (MO), *Ebinger 351* (MO), *Gentry 4939* (MO), *Hammel 3743* (MO), *Mori & Bolten 7697* (MO), *Sheffer 179* (MO), *Sullivan 439* (MO); vicinity Cerro Jefe, *Croat 22668, 35882* (MO); El Llano-Cartí Road, *Croat 26041* (MO), *Sytsma 1723* (MO); vicinity El Llano, *Duke 5623* (MO), *Tyson 6840* (MO); along Río Majé near Bayano Lake, *Croat 34689* (MO).

SAN BLAS: rainforest on Aila Tiwar, *Sugden 413* (MO); SW of Mulatupo, *Duke 14225* (MO); E of Puerto Obaldía, *Croat 16906* (MO).

Anthurium caloveboranum Croat, sp. nov. TYPE: Panama. Veraguas: along trail between Escuela Agricola Alto Piedra (above Santa Fe) and Río Dos Bocas, ca. 10 km from the agricultural school, 530–620 m, *Croat 25900* (MO 2276325, holotype; GH, isotype).

Planta epiphytica; cataphyllum membranaceum; petiolus late sulcatus ad adaxialis camplanatus, (8–)15–24 cm longus; lamina subcoriacea, oblongo-elliptica, basi acuta, 17–29 cm longa, 4–6 cm lata, pagina inferiore glanduloso-punctata; inflorescentia lamina folius breviora; pedunculus 13–28 cm longus; spatha modice membranacea, viridis aut viridis tincta rubra aut alba, lanceolata, 2.2–6 cm longa, 5–13 mm lata; spadix viridis, 7–9 cm longus; baccae globosae, rubrae, apici depressae.

Epiphyte; stems less than 15 cm long, ca. 1 cm diam.; leaf scars obscured by cataphylls; roots slender, numerous, descending; cataphylls thin, 2.5–3.5 cm long, acuminate at apex, drying reddish brown, weathering to fine fibers. LEAVES semierect; petioles (8–)15–24 cm long, ca. 5 mm diam., broadly sulcate to flattened adaxially (often drying sharply triangular); geniculum terete, 0.5–1 cm long; blades moderately thick, oblong-elliptic, gradually acuminate at apex, acute at base, 17–29 cm long, 4–6 cm wide, broadest at middle or just below; upper surface semiglossy; dark glandular-punctate and paler below; midrib obtusely raised above, raised below (dry); primary lateral veins 7–10 per side, departing midrib at 35–40° angle; weakly sunken above, prominulous below; interprimary veins (dry) scarcely less prominent than primary lateral veins; submarginal collective veins arising from the base, 3–6 mm from the margin, sunken above, raised below. INFLORESCENCE shorter than leaves; peduncle 13–28 cm long, 2–4 mm diam., equalling or longer than petioles; spathe moderately thin, greenish or green tinged with red or whitish, lanceolate, 2.2–6 cm long, 5–13 mm wide, acuminate at apex, acute at base, inserted at 45° angle on peduncle; spadix green, 7–9 cm long, 4–5 mm diam. near base, 2–3 mm diam. near apex; flowers rhombic to 4-lobed, 3.4–3.6 mm long, 1.8–2.2 mm wide, the sides jaggedly sigmoid, 4–5 flowers visible in the principal spiral, 3–4 flowers visible in the alternate spiral; tepals matte (dry), lateral tepals ca. 2.8 mm wide, the inner margin broadly rounded; pistils not raised, green; stigmas linear, ca. 0.2 mm long; stamens retracted after anthesis. INFRUCTESCENCE with berries globose, red, 4–5 mm diam., depressed at apex; seeds 3–11, ovate-ellipsoid to rarely elliptic, tan, slightly flattened, 2–2.3 mm long, 1–1.8 mm wide, 0.8–1 mm thick. Fig. 31.

Anthurium caloveboranum is endemic to western Panama in tropical wet or premontane rain forest at 200 to 1,200 m.

The species is a member of section *Porphyrochitonium* and is distinguished by its lanceolate-elliptic to oblong, gradually long-acuminate blades that dry grayish green to grayish brown and lack glandular punctations on the upper surface. Other features include a subterete petiole, the generally elongate, slightly tapered, green spadix, and red berries that are depressed at the apex at maturity.

It is most similar to *Anthurium pageanum,* which has similar berries. *Anthurium pageanum* differs in having a sharply three-sided petiole with a generally undulate, sharp margin on the geniculum and in having glandular punctations on the upper blade surface.

The number of seeds produced per berry is variable. *Croat 25636* has berries with three to five seeds, whereas *Croat 25900* (the type) has eight to 11 seeds per berry.

BOCAS DEL TORO: along Chiriquí Province border near Continental Divide, Carretera del Oleoducto, ca. 1 km N of Quebrada Arena, *Knapp 5079* (K, MO, PMA).

CHIRIQUÍ: Continental Divide above Quebrada Arena, *Knapp & Vodicka 5675* (MO).

COCLÉ: above El Petroso sawmill at Continental Divide, N of El Copé, *Sytsma & Andersson 4607* (MO).

VERAGUAS: Río Concepción to Río Barrera, *Hammel 5161, 5171* (MO); trail from Coquito Mine to Río Barrera junction with Río Concepción, *Hammel 5218* (MO); headwaters of Río Caloveborita, ca. 15 km below Escuela Agricola Alto Piedra, above Santa Fe, *Sytsma & Andersson 4766, 4767, 4771* (MO); road between Escuela Agricola Alto Piedra & Río Dos Bocas, *Croat 25900* (GH, MO), *Mori & Kallunki 3109* (MO); 11 km beyond Santa Fe, *Croat 25624, 25636* (MO).

Anthurium caperatum Croat & Baker, Brenesia 16(Supl. 1): 32. 1979. TYPE: Costa Rica. Heredia: vicinity Bajo la Hondura, along road between Paracito and the Río Claro, 1,100–1,400 m, *Croat 44518* (MO 2598657–58, holotype; CR, F, K, NY, US, isotypes).

Epiphytic near the ground or terrestrial; stem 60–120 cm long, 2.5–5 cm diam.; cataphylls drying pale brown, weathering into fine fibers; petioles 24–109 cm long, 6–15 mm diam., subterete, shallowly and bluntly sulcate; blades ovate to narrowly ovate, subcoriaceous, usually weakly bullate, prominently lobed at base, 46–120 cm long, 30–69 cm wide. Inflorescence erect; peduncle 6–54 cm long, 8–13 mm diam., subterete or terete; spathe thin, pale green, lanceolate-oblong, 10–28 cm long, 3.3–4.8 cm wide; spadix sessile, pale green (3–)7–18(–28) cm long, 10–20 mm diam. at base; berries greenish white to yellowish green at base, ovate to ovate-elliptic, to 9 mm long, ca. 5 mm diam.; seeds 2. See Croat (1983: 261) for a more complete description.

The species is known from Costa Rica and Panama and is to be expected in Colombia on the southwestern slopes of the Serranía de Pirre. It occurs on both the Atlantic and Pacific slopes. In Costa Rica, it ranges from 850 to 2,000 m but in Panama it has been collected as low as 400 m. The species inhabits premontane wet, premontane rain, and lower montane rain forest.

Anthurium caperatum is in section *Polyneurium* and is recognized by its large, ovate slightly bullate leaves, its green brittle spathe, its pale green spadix, and its greenish berries. The species is similar to *A. panamense,* but that species has more elongate blades that are glossier on the upper surface, less protruded styles, weakly ribbed petioles, and red berries.

Collections from Darién Province of Panama are unusual with spadices more slender and relatively longer, a generally thinner spathe (drying membranous), and some of the specimens have the collective vein relatively more remote from the margin (*Folsom 4365* is particularly noteworthy in this respect). The specimens involved, *Croat 37790, Folsom 4232, 4365, 4517,* and *6320,* may ultimately prove to be a distinct species. With the exclusion of these collections, the species ranges no further east than Cerro Campana in Panamá Province.

CHIRIQUÍ: Bajo Chorro, Boquete Dist., *Davidson 284* (MO, US); Cerro Colorado, *Croat 37152* (F, MO, PMA), *48443* (BH, FTG, MO, SEL); Cerro Pata de Macho, *Croat 48554* (BH, MO); E of Fortuna main campsite, *Folsom et al. 5288, 5503* (MO); vicinity Gualaca, *Antonio 5007, 5063, 5064, 5122* (MO), *Croat 48664* (MO); between Gualaca & Fortuna Dam site, *Croat 49832* (FTG, MO), *49925, 49958, 50027* (MO); Questra Piedra along Río Monte Road, *Folsom 3984* (MO); above San Félix, *Croat 33140* (MO).

COCLÉ: Alto Calvario, *Croat 49178* (MO); N of El Copé, *Croat 44595* (MO, US), *44735* (MO), *Folsom & Robinson 2379* (MO), *Folsom 3242* (MO), *Folsom et al. 5678, 5964* (MO); El Potroso, *Folsom & Collins 1555, 1562* (MO).

DARIÉN: Cerro Pirre, *Folsom 4459, 4517, 6320* (MO); Serranía de Pirre, *Croat 37881A* (RSA), *37849* (MO).

PANAMÁ: Cerro Campana, *Allen 2419* (US), *Croat 22777, 35995* (MO), *Sheffer 273* (MO); vicinity Tres Bocas, *Kirkbride & Duke 1161* (NY); on the road to Cartí, *Kennedy 3440* (F).

VERAGUAS: on road to Calovébora, *Croat 33956* (MO, PMA); Cerro Tute, *Croat 48928, 48939* (MO), *Folsom & Mauseth 8372* (MO); along banks of river between Agricultural School & Río Calovébora, *Croat 34147* (MO); vicinity Agricultural School near Santa Fe, *Croat 48911* (MO), *Sytsma & Andersson 4777* (MO); NW of Santa Fe, *Mori et al. 3814* (MO); valley of Río Dos Bocas between Alto Piedra & Calovébora, *Croat 27449, 27712A* (MO).

Anthurium carnosum Croat & Baker, Brenesia 16(Supl. 1): 36. 1979. TYPE: Costa Rica. San José and Cartago Provinces: along Pan-American Hwy. near El Trinidad and Km 72 (ca. 20 km SE of Empalme), cut over area, 2,600–2,800 m, *Burger & Baker 9545* (F 1831851, holotype; MO 2603241, 238546, isotypes).

Epiphytic vine, rarely terrestrial; stems slender, cane-like, erect or trailing, to 1 m or more long, 5–7 mm diam., encircling stem, persistent at upper nodes, drying thin, dark brown, deciduous except for a few pale thread-like fibers; petioles 3–12 cm long, 2–3 mm diam., weakly sulcate; blades coriaceous, lanceolate-elliptic, narrowly elliptic or sometimes oblanceolate-elliptic, acute to attenuate at base, (7–)9–15(–17) cm long, (1.7–)2.5–5(–7) cm wide. Inflorescence spreading; peduncle 7–13 cm long, ca. 2 mm diam.; spathe thin, pale green, broadly lanceolate

to oblong, 2.5–4.3 cm long, 8–14 mm wide; stipe 5–8 mm long; spadix green, becoming yellowish, (2.5–)3–5.5 cm long, 3–4 mm diam. at base; berries yellow, becoming bright orange, ovoid, acute at apex, 9–11 mm long, 6–8 mm diam.; usually 2, sometimes 3–4 seeds. See Croat (1983: 263) for a more complete description.

Anthurium carnosum ranges from Costa Rica to Panama at elevations from (700 to) 1,500 to 2,600 (to 3,000) m in premontane rain, lower montane wet, lower montane, and montane rain forest life zone formations. In Panama, the species is widespread in Chiriquí Province and is also known from adjacent Bocas del Toro and from Veraguas.

Anthurium carnosum is in section *Xialophyllium* and is recognized by its scandent habit, its thick succulent leaves with strongly discolorous surfaces, its short greenish spadix, and its yellow to orange berries. Among Panamanian species, *A. carnosum* is most closely related to *A. pittieri* and *A. interruptum* but differs from *A. pittieri* by its longer internodes, its viney habit, its nondecurrent spathe, and its thick, succulent leaves. It differs from *A. interruptum* in its higher altitudinal range, its short-stipitate spadix, its orange (versus red) berry color, its shorter internode length, and its thicker leaves.

BOCAS DEL TORO: NW ridge of Cerro Pata de Macho, *Sytsma et al. 4964* (MO), *Kirkbride & Duke 991* (MO); Valle de Silencio, *Antonio 1618* (K, MO, NY, PMA).

CHIRIQUÍ/BOCAS DEL TORO: road along top of Cerro Colorado, *Folsom et al. 4721* (MO); summit & ridge N of Cerro Pando, *Knapp 1625* (MO).

CHIRIQUÍ: Cerro Horqueta, *Cochrane et al. 6270* (F, MO, WIS), *D'Arcy et al. 12686* (MO), *Hagen & Hagen 2035* (MO, NY), *Luteyn 3778, 3782* (DUKE, MO), *Proctor 31917* (LL), *Wilbur et al. 17303* (DUKE), *Wilbur & Luteyn 19225* (DUKE); Cerro Hornito, *Folsom et al. 7255* (MO), *Mori & Bolten 7462, 7464* (MO); Cerro Pata de Macho, *Knapp et al. 2081* (MO), *Sytsma 4898* (MO); slopes of Cerro Punta, *Croat 48619* (MO), *Gentry 5894, 5895* (MO); vicinity Guadalupe, *Folsom 6033* (MO), *Maas & Dressler 4849* (MO), *Wilbur et al. 13082* (MO); vicinity Las Nubes, *Almeda 3511* (CA), *Croat 26413* (MO), *Hammel 1427* (MO), *Luteyn 3809* (DUKE), *Mori & Bolten 7236* (MO), *Utley et al. 246* (DUKE), *Wilbur et al. 15238* (DUKE); N of San Félix, *Mori & Kallunki 5950, 5971* (MO); Cerro Colorado, near Continental Divide, *Antonio 1514, 1515* (MO); Fortuna Dam site, *Folsom et al. 5413* (MO).

VERAGUAS: Cerro Tute, *Mori 6251* (MO, US), *6779* (MO, PMA).

Anthurium cartiense Croat, sp. nov. TYPE: Panama. Panamá: El Llano-Cartí Road, 10 mi. from Pan-American Hwy. near El Llano, 330 m, *Croat 33803* (MO 2815426, holotype; B, F, K, PMA, UC, US, isotypes; Live at MO).

Planta epiphytica; cataphyllum coriaceum, persistens findens in fibris; petiolus subteres, sulcatus, 10–22(–30) cm longus; lamina subcoriacea, oblongo-elliptica, basi obtusa ad rotundata, 10–33 cm longa, 4.5–8.5 cm lata, pagina inferiore glanduloso-punctata; inflorescentia effusa; pedunculus triangularis, 2–5-costatus, 34–47 cm longus; spatha subcoriacea, viridis, dilute tincta rubra-purpurea, oblongo-lanceolata, 4.3–4.5 cm longa, ca. 1.8 cm lata; spadix viridis aut viridis tinctus purpureus, 5.5–8.5 cm longus; baccae ignotae.

Epiphyte; stems less than 20 cm long, ca. 2 cm diam.; roots dense, green, descending; cataphylls coriaceous, 4–5 cm long, acute at apex, drying dark brown (B & K Yellow 4/2.5), weathering to persistent fibers. LEAVES spreading; petioles 10–22(–30) cm long, 4–5 mm diam., subterete, sharply and shallowly sulcate, faintly ribbed medially, the sides flattened and parallel to one another; geniculum 1–1.5 cm long; blades oblong-elliptic, moderately thick, acuminate at apex, obtuse to rounded at base, 10–33 cm long, 4.5–8.5 cm wide, broadest near middle; upper surface semiglossy, eglandular, lower surface much paler, matte, densely glandular-punctate; midrib convexly raised above and below, diminishing and sunken at apex above; primary lateral veins 10–16 per side, departing midrib at 30° angle, merely etched in surface of blade above, prominulous below, straight to collective vein; lesser veins obscure above, prominulous below; collective vein arising near the base, etched above, prominulous below, 3–6 mm from margin. INFLORESCENCE spreading, sometimes shorter than leaves; peduncle 34–47 cm long, 4–5 mm wide, triangular, sometimes 2–5-ribbed or winged, often twisted, sometimes tinged red-violet, 2–5 times longer than petioles; spathe medium thick, green (B & K Yellow-green 8/10), sometimes faintly tinged red-violet, oblong-lanceolate, 4.3–4.5 cm long, ca. 1.8 cm wide, broadest at base, acuminate at apex, rounded to truncate at base, spreading at a 90° angle, twisted longitudinally and turned up near apex, inserted at 50° angle on the peduncle; spadix green or green tinged purplish (B & K Yellow-green 4/10–5/10), 5.5–8.5 cm long, 5–8 mm diam. at base, 3–4 mm diam. at apex; flowers square, 3–4.5 mm long, 2.8–3.8 mm wide, the sides straight to gradually sigmoid, ca. 5 flowers visible in the principal spiral, ca. 7 flowers visible in the alternate spiral; tepals semiglossy, minutely papillate, lateral tepals 2.3–3 mm wide, the inner margin straight; pistil slightly raised, green becoming dark

purple or green tinged dark purple; stigma linear, 0.4–0.5 mm long, green, minutely exserted, moist with minute droplets ca. 3 days before stamens emerge; stamens emerging in a regular sequence beginning at the base, laterals first quickly followed by alternates, the first lateral retracting below tepals as first alternate emerges; anthers pale green, completely retracting beneath tepals, leaving traces of white pollen. INFRUCTESCENCE not seen; berries probably lavender. Figs. 29 and 30.

Anthurium cartiense is endemic to Panama and is known only from the El Llano-Cartí Road in Panamá and from the Santa Rita Ridge in Colón Province east of the previous Canal Zone.

The species is a member of section *Porphyrochitonium* and is closely related to *Anthurium crassiradix* with which it shares somewhat oblong, glandular-punctate (lower surface only), subcoriaceous leaf blades and an elongate, three-sided, somewhat winged peduncle that usually greatly exceeds the petiole. *Anthurium crassiradix* differs in having a slender, much more elongate spadix and blades that are commonly broader below the middle, frequently with a well-developed secondary collective vein and the tendency to become subcordate in age. *Anthurium cartiense* differs from *A. crassiradix* in having a short, weakly tapered spadix and blades that are broadest in the middle.

An unusual feature that may be shared by both species is the much thickened coralloid mass of roots. I have seen this species only once in the field and did not make a note of this character on *Anthurium cartiense,* although it was present on specimens of *A. crassiradix.* However, one collection of *A. cartiense* (*Nee 7916*) notes the presence of such roots.

COLÓN: Santa Rita Ridge Road, *Sytsma 1322* (MO).
PANAMÁ: El Llano-Cartí Road, *Croat 33803* (B, F, K, MO, PMA, UC, US), *Kennedy 2509* (MO), *Mori & Kallunki 4708* (MO), *Nee 7916* (MO, PMA).

Anthurium cerrocampanense Croat, Selbyana 5: 316. 1981. TYPE: Panama. Panamá: middle slopes of Cerro Campana, ca. 1 mi. from Pan-American Hwy., ca. 600 m, *Croat 35944* (MO 2388983, holotype; K, PMA, US, isotypes; Live at MO).

Usually terrestrial and deeply rooted, rarely epiphytic, 30–100 cm tall; stem short, 2–2.5 cm diam., internodes short; leaf scars to 2.5 cm wide, cataphylls drying brown, persisting intact. LEAVES erect-spreading; petioles 14–50 cm long, 5–9 mm wide, 3-sided, sharply winged (or the abaxial side sharply 2-ribbed) the wings sometimes wavy; geniculum 1.5–2 cm long; blades ovate to broadly ovate, subcoriaceous, gradually to abruptly short-acuminate at apex, deeply lobed at base, (13–)20–40(–55) cm long, (13.5–)15–35 (–40) cm wide, broadest at middle or just below; the upper surface semiglossy, the lower surface much paler, matte or semiglossy; midrib obtusely raised above, diminishing and sunken at apex, sharply raised below, basal veins 4–6(–7) pairs, up to 4 of them coalesced 1–2.5 cm, raised in valleys on upper surface; the posterior rib more or less straight, naked or not; primary lateral veins 6–10 per side, departing the midrib at 30–50° angle, straight then arcuate-ascending to the collective vein, weakly raised in valleys above, prominent below; interprimary veins few, prominulous above; collective veins arising from one of the basal veins, loop-connected, mostly 3–17 mm from margin. INFLORESCENCE erect, shorter than leaves; peduncle 14–30 cm long, 5–8 mm diam., subterete, sharply 1(–2)-ribbed abaxially below middle, spathe light green to yellowish green, streaked dark green or purple, oblong-lanceolate, (3–)10–14 cm long, (1–)2–3 cm wide, broadest ca. 1 cm above the peduncle, gradually acuminate at apex (the acumen hooked), rounded to obtuse at base, spreading to reflexed, inserted at ca. 45° angle on peduncle; spadix sessile, green, (2.6–)5–14.5 cm long, (4–)6–12 mm diam. near base, with a strong perfume-like scent when stigmas have droplets and when anthers are fresh; flowers rhombic or weakly 4-lobed, 3.1–3.8 mm long, 2.8–3.5 mm wide, the edges nearly straight on sides paralleling the flower spirals, usually jaggedly sigmoid at alternate edge, sometimes jaggedly sigmoid on both sides, 8 flowers visible in the principal spiral, ca. 5 flowers visible in the alternate spiral; tepals glossy, smooth, sometimes with minute droplets; the inner margin more or less straight; pistils darker green than tepals, glossy; stigma oblong, ca. 0.6 mm long; stamens emerging more or less rapidly from the base or scattered throughout spadix, weakly exserted above the tepals, soon retracting, withdrawing most of the anther beneath the tepals, the pollen deposited at edge of tepal, anthers ephemeral, 0.3–0.6 mm long, 0.6–0.8 mm wide, thecae oblong-ellipsoid, scarcely or not divaricate, pollen orange. INFRUCTESCENCE spreading; berries violet purple at apex, white at base, obovoid, ca. 6.5 mm long, 5 mm diam.;

FIGURES 17–20. 17, 18. *Anthurium cerrocampanense* Croat, *Croat 49130*.—19, 20. *Anthurium coclense* Croat, *Croat 34144*.

seeds 1 or 2, 4–4.3 mm long, 2.7–3.7 mm wide, 1.7–2.4 mm thick, pale brown, emarginate at apex, rounded to obtuse at base. Figs. 17, 18, and 21.

The species is known only from the vicinity of the Isthmus of Panama in premontane wet and tropical wet forest life zones at 500 to 1,000 m. It is most abundant west of the Canal Zone.

The species is a member of section *Cardiolonchium* and is apparently not closely related to any other known species in the section. It can be recognized by its cordate blade, its sharply three-sided winged petiole, its terrestrial habit, its green to golden yellow spadix that exudes pollen in ribbons, and by its violet purple berries.

COCLÉ: Cerro Pilón, *Porter et al. 4634, s.n.* (MO); vicinity El Copé, *Folsom 6205, 7084* (MO), *Hammel 2381, 2625* (MO); El Potroso, *Folsom 1551* (MO); El Valle de Antón, *Allen 341* (NY), *Hunter & Allen 341* (MO), *Kennedy et al. 3195* (MO), *Allen & Alston 1845* (MO), *Woodson & Schery 194* (K, MO); La Mesa, *Croat 37365* (MO, PMA); N of Llano Grande, *Hammel 1957* (MO).

COLÓN: Santa Rita Ridge Road, *Antonio 3753* (MO).

PANAMÁ: Cerro Campana, *Allen 2433* (US), *Croat 12077, 17163, 25207* (MO), *35944* (K, MO, PMA, US), *12134* (B, CAS, DUKE, MO, NY, RSA, S, UC, VEN), *D'Arcy 11122* (MO), *Kennedy 235, 1163* (F), *Kennedy et al. 2059* (MO), *Liesner 629* (MO), *Luteyn 1002* (DUKE), *Porter et al. 4255, 4950* (MO), *Sheffer 272* (MO), *Kirkbride & Duke 1654* (MO); El Llano-Cartí Road, *Croat 22854* (MO, PMA).

Anthurium cerropirrense Croat, sp. nov. TYPE: Panama. Darién: Serranía de Pirre, 9–10 km N of Alturas de Nique, lower montane rain forest (Holdridge Life Zone System), 1,520–1,560 m, *Croat 37857* (MO 2416646, holotype; K, PMA, US, isotypes; Live at MO).

Planta epiphytica; caudex usque 20 cm longus; cataphyllum subcoriaceum, deciduum; petiolus teres, 26–47.5 cm longus; lamina subcoriacea, lanceolata ad anguste elliptica, basi acuta ad late rotundata, 23–48 cm longa, 5.5–13 cm lata; inflorescentia effusa; pedunculus teres, 28–60 cm longus; spatha modice membranacea, viridis, linearis-lanceolata, 5.5–10 cm longa; spadix olivaceus pallidus, 11–12 cm longus; pistillum purpureum; baccae purpurascentes, 8 mm longae.

Epiphyte; stems elongate 20 cm or more long; internodes 0.8–1 cm long; roots few, thick, green; leaf scars 1.5–2 cm wide; cataphylls subcoriaceous, 15–17 cm long, acute at apex, drying brown, persisting briefly intact, soon deciduous. LEAVES spreading; petioles 26–47.5 cm long, terete; geniculum 1.5–2.5 cm long; blades subcoriaceous, lanceolate to narrowly elliptic, long acuminate at apex, acute to broadly rounded at base, 23–48 cm long, 5.5–13 cm wide, broadest at the middle or just below; both surfaces matte to semiglossy with numerous, minute raphide cells; midrib scarcely raised, convex at base, more acute at middle, sunken at apex above, prominently and convexly raised below; primary lateral veins 12–14 per side, departing the midrib at 35–45° angle, arcuate to collective vein, sunken above, raised below; interprimary veins flat above, prominulous below; collective vein arising from one primary lateral vein usually in the lower one-third of the blade, sunken above, raised below, 4–7 mm from the margin. INFLORESCENCE spreading, shorter than leaves; peduncle 28–60 cm long, 2.5–3 mm diam., terete, ca. 2 times longer than petioles; spathe moderately thin, green (B & K Yellow-green 6/7.5), linear-lanceolate, 5.5–10 cm long, acuminate at apex, obtuse to acute at base, inserted at 65–70° angle; stipe 3–7 mm long; spadix pale olive green, 11–12 cm long, 5–6 mm diam. near base, narrowly tapered at apex; flowers rhombic to 4-lobed, 2–2.6 mm long, 2–2.4 mm wide, the sides straight to weakly sigmoid, 4–7 flowers visible in the principal spiral, 7–10 flowers visible in the alternate spiral; tepals matte to semiglossy, minutely papillate, lateral tepals 1–1.8 mm wide, the inner margin straight to weakly concave; pistils emergent, tinged violet purple; stigmas green, oblong-elliptic, 0.5 mm long; stamens emerging in a scattered manner beginning at base, laterals emerging one at a time, the third and fourth stamens emerging several days after laterals, exserted on translucent filaments ca. 3 mm long, retracting to hold anthers at level of tepals; anthers pale yellow-orange, 0.3–0.5 mm long, 0.5–0.7 mm wide; thecae ovate-elliptic, weakly divaricate; pollen yellow-orange, fading to white. INFRUCTESCENCE probably with purple berries, acute at apex, ca. 8 mm long, ca. 3 mm wide (dry). Figs. 12, 15, and 16.

Anthurium cerropirrense is known only from Cerro Pirre in Darién Province in Panama at 800 to 1,560 m in lower montane rain forest.

The species, tentatively placed in section *Xialophyllium,* is distinguished by its elongated stem with short internodes, its long cataphylls, and by its narrowly elliptic to lanceolate leaf blades with the collective vein arising from one of the primary lateral veins in the lower third of blade. It

FIGURES 21–24. 21. *Anthurium cerrocampanense* Croat, *Croat 12134*.—22. *Anthurium coclense* Croat, *Croat 34144*.—23, 24. *Anthurium barryi* Croat, *Hammel 7258*.

is also distinguished by its pale olive green spadix with emergent, purplish pistils and berries.

It is probably most closely related to *Anthurium testaceum* from western Panama near Costa Rica, but that species has fewer flowers per spiral with prominently raised tepals and red berries. In addition *A. testaceum* has more elongate internodes (at least in the lower part of the stem). One specimen (*Folsom 4504*) of *A. cerropirrense* has a similar leaf shape to that of *A. testaceum* but has the flowers and berries of *A. cerropirrense*.

In the revision of the *Anthurium* of Costa Rica (Croat & Baker, 1979), several collections of *A. cerropirrense* were listed in the exsiccatae of *A. testaceum*. These are *Bristan 619, Duke & Elias 13822, Duke 6094,* and *Folsom 4504*.

DARIÉN: Cerro Pirre, *Bristan 619* (MO, OS), *Croat 37857* (K, MO, PMA, US), *Duke 6094* (MO), *Duke & Elias 13822* (MO), *Folsom 4504* (MO).

Anthurium chiriquense Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 67. 1940. TYPE: Panama. Chiriquí: Bajo Chorro, Boquete Dist., 1,800 m, *Davidson 283* (F, holotype; MO 1154936, isotype).

Epiphyte; stems short; roots thin directed downward; cataphylls 8–10 cm long, drying straw-colored, persisting as coarse disoriented fibers. LEAVES with petioles 20–33 cm long, ca. 5 mm diam., subterete weakly sulcate; blades oblong-elliptic, 29–39 cm long, 7–12 cm wide, broadest at middle, abruptly to gradually acuminate at apex, obtuse at base, sparsely glandular-punctate on both surfaces; midrib sharply raised above, moderately flat below; primary lateral veins 10–12 per side, departing midrib at 45° angle; submarginal collective vein arising from base, prominulous on drying, scarcely more prominent than the interprimary veins, 5–9 mm from margin. INFLORESCENCE as long or longer than leaves; peduncle 27–41 cm long, 3–5 mm diam., terete, longer than petioles; spathe purplish, oblanceolate, 6.5–8 cm long, 1–1.5 cm wide; inserted at ca. 30° angle on peduncle; spadix stipitate, 1.5–1.7 cm long, slightly tapered toward apex, purple to reddish brown, 12–25 cm long, 4–7 mm diam.; flowers rhombic, 2.5–4 mm long, 3–5 flowers visible in the principal spiral; stamens weakly exserted (?), anthers 0.6 mm wide; thecae ovate; staminal progression not known. INFRUCTESCENCE not seen. Fig. 9.

Anthurium chiriquense is endemic to Panama in Chiriquí Province at 1,900 to 2,000 m. Until recently the species had been collected only twice at Bajo Chorro (NW of Boquete) about 40 years ago.

The species is distinguished by its epiphytic habit, its slender stem with coarse, persistent, straw-colored cataphyll fibers, its long petioles nearly equalling the blade, its large oblong-elliptic, glandular-punctate blades that are stoutly three-veined and obtuse at the base with the collective vein 5–10 mm from the margin, and by its long-pedunculate inflorescence with a long-stipitate, slender, reddish to purplish spadix.

Standley states in the type description that the species is epunctate (which isn't true) and that it is related to *A. turrialbense* (now a synonym of *A. bakeri*), to which it is only distantly related. Both are members of section *Porphyrochitonium*.

Anthurium chiriquense is most closely related to *A. circinatum* from Cerro Colorado, and perhaps that species will prove to be separated from it at only the subspecific level. *Anthurium circinatum* differs in having more coriaceous blades that are usually round at the base, drying weakly glossy on the lower surface, and has a spadix that becomes spiralled as it matures. *Anthurium chiriquense,* on the other hand, has thinner blades that are acute at the base, drying matte on the lower surface and has spadices that do not show evidence of coiling in age.

CHIRIQUÍ: Bajo Chorro, Boquete Dist., *Davidson 283* (F, MO), *Woodson & Schery 678* (MO); Cerro Pata de Macho, *Kress et al. 82-1377* (DUKE).

Anthurium chorranum Croat, sp. nov. TYPE: Panama. Panamá: Serranía de Cañasas, area surrounding Rancho Chorro, mountains above Tortí Arriba, 400–700 m, *Folsom et al. 6640* (MO 2623909, holotype; PMA, isotype).

Planta epiphytica; internodia usque 3 cm longa aut longiora; cataphyllum persistens intactum, denique deciduum; petiolus 29–35 cm longus adaxialis complanatus; lamina modice membranacea, anguste triangularis ad anguste hastato-triangularis, basi cordata, 45–49 cm longa, 13–16.5 cm lata; inflorescentia plus minusve erecta; pedunculus 18–21 cm longus, teres; spatha modice membranacea, viridis, oblongo-lanceolata, ca. 6–8 cm longa, 8 mm lata; spadix viridis, 6–8.5 cm longus; baccae ignotae.

Epiphyte; stem ca. 1 cm diam.; internodes to 3 cm or more long; leaf scars inconspicuous; roots few per node, slender and elongate; cataphylls

moderately thick, to 11 cm long, remaining intact, soon deciduous. LEAVES with petioles 29–35 cm long, flattened adaxially with low erect margins; geniculum ca. 1.5 cm long; blades moderately thin, narrowly-triangular to narrowly hastate-triangular, narrowly acuminate at the apex (the acumen flat), prominently lobed at the base, 45–49 cm long, 13–16.5 cm wide, broadest at the base; anterior lobe 43–44 cm long, the margins almost straight to concave, posterior lobes 8–9.3 cm long (from apex of sinus to tip of lobe), directed downward to outward at ca. 45° angle, narrowly rounded at base; the sinus arcuate or hippocrepiform to parabolic, 3.5–6 cm deep; both surfaces drying matte, slightly paler below; midrib narrowly raised on both surfaces; basal veins 4 or 5 pairs, the first and second pairs free or nearly so, the remainder coalesced ca. 1.5 cm, naked; primary lateral veins 9–12 per side, departing the midrib at 45–60° angle, arcuate to the collective vein, drying moderately obscure above, prominent below; interprimary and secondary veins mostly less prominent than the primary lateral veins; collective vein arising from the first or second basal vein but some of the lower basal veins loop-connecting with the collective vein, moderately straight or weakly loop-connecting the primary lateral veins, 3–5 mm from the margin, weakly sunken above, raised below. INFLORESCENCE semierect; peduncle 18–21 cm long, 2–3 mm diam., terete; spathe moderately thin, green with dense raphide cells visible, oblong-lanceolate, 6.8 cm long, ca. 8 mm wide, broadest near the base, narrowly long-acuminate at apex, rounded at base, inserted at ca. 45° angle on peduncle; stipe to 2 mm long; spadix green, scarcely tapered, 6–8.5 cm long, 4–5 mm diam.; flowers rhombic, ca. 2 mm long, 1.5 mm diam., ca. 5 flowers visible in the principal spiral, 6–8 flowers visible in the alternate spiral, tepals weakly glossy on drying, yellowish brown, the lateral tepals 1 mm wide, the inner margin broadly rounded; pistils not emergent; stamens persisting in a tight cluster over the pistil; anthers ovoid, ca. 0.5 mm long. INFRUCTESCENCE not seen. Figs. 27 and 28.

Anthurium chorranum is known only from the type collection from Panama in the Serranía de Cañasas in southeastern Panamá Province at 400 to 700 m in what is probably tropical wet or premontane rain forest.

The species is perhaps best placed in section *Polyneurium* and is distinguished by its slender stems, its somewhat elongate internodes, its intact, deciduous cataphylls, and by its moderately thin, narrowly triangular to narrowly hastate-triangular blades. It is apparently related to *Anthurium niqueanum* from the Serranía de Pirre with which it shares elongate internodes, intact, deciduous cataphylls, and a similar blade shape. The latter differs, however, in having a thicker blade with much more prominent veins and in having stems, petioles, and peduncles with a thin waxy layer.

The name of the species refers to the type locality at Rancho Chorro.

PANAMA: Serranía de Cañasas, above Tortí Arriba, *Folsom et al. 6640* (MO, PMA).

Anthurium chromostachyum Croat, sp. nov. TYPE: Panama. Darién: E base of Cerro Sapo, 1,000 m, *Hammel 1130* (MO 2634169, holotype; PMA, isotype).

Planta epiphytica; cataphyllum persistens intactum; petiolus teres, 25–34 cm longus; lamina oblongo-triangularis, subcoriacea, basi subcordata, usque 31 cm longa, 10–13 cm lata; inflorescentia foliis breviore; pedunculus teres, 18–26 cm longus; spatha subcoriaceae, oblongo-elliptica, 5.5–7.5 cm longa, 1.7–2.3 cm lata; spadix luteus ad roseus; baccae ignotae.

Epiphyte; stems ca. 1 cm diam., internodes short; cataphylls subcoriaceous, 10–13 cm, acuminate at apex, turning reddish brown, persisting intact. LEAVES with petioles erect and blades pendent; petioles terete; 25–34 cm long, ca. 4 mm diam.; blades oblong-triangular, subcoriaceous, narrowly long-acuminate at apex, subcordate at base, to 31 cm long, 10–13 cm wide, broadest at the base; the anterior lobe 29–33 cm long, more or less straight along most of the margin, the posterior lobes 4.5–6 cm long, directed somewhat outward; the sinus arcuate to parabolic; the surfaces drying matte with many, minute raphide cells visible on the upper surface, the lower surface only slightly paler than the upper surface; basal veins 4–5 pairs, the first 3 pairs free to the base, the fourth to fifth free or weakly coalesced; primary lateral veins 4–6 per side, departing the midrib at 25–40° angle, moderately straight to arcuate to the collective vein, drying prominulous below; interprimary veins frequent; the tertiary veins moderately obscure; collective vein arising from the first basal vein, inconspicuous, loop-connecting the primary lateral veins. INFLORESCENCE usually shorter than the leaves; peduncle 18–26 cm long, 3–4 mm diam., terete, two-thirds as long as or slightly longer

FIGURES 25–28. 25. *Anthurium chromostachyum* Croat, *Hammel 1130.*—26. *Anthurium collinsii* Croat, *Folsom et al. 6676.*—27, 28. *Anthurium chorranum* Croat, *Folsom et al. 6640.*

than the petioles; spathe subcoriaceous, oblong-elliptic, 5.5–7.5 cm long, 1.7–2.3 cm wide, abruptly acuminate at the apex, somewhat clasping at the base, inserted at ca. 45° angle on the peduncle; spadix sessile, yellowish to rose-colored, scarcely tapered toward the apex, 4–6 cm long, 5–6 mm diam., the flowers 4-lobed, 1.2–1.5 mm wide in both directions, 8–12 flowers visible in the principal spiral; tepals drying matte, the lateral tepals 0.6–0.9 mm wide, the inner margin straight to broadly rounded; the anthers ca. 0.35 mm long, 0.25 mm wide (dried), held in a tight cluster around the pistil. INFRUCTESCENCE not seen. Fig. 25.

Anthurium chromostachyum is endemic to Panama in the Serranía del Sapo in southeastern Darién Province at 330 to 830 m in what is probably a premontane wet or premontane rain forest life zone.

The species, a member of section *Calomystrium,* is distinguished by its slender stem, its persistent, intact cataphylls, its terete petioles, its subcoriaceous, oblong-triangular blade with a subcordate base, and by its inflorescence that is shorter than the leaves with a yellowish to rose-colored spadix.

The species is probably most closely related to *Anthurium cucullispathum,* another member of section *Calomystrium* that has a similar blade shape. The latter species, with only one dubious collection from eastern Panama, is known principally from Veraguas and Coclé Provinces. It differs in having blades that dry with more prominent veins and with a dense pattern of dark, elevated gland-like structures on the lower surface (visible without a lens). It also differs in having a white spadix at anthesis.

Antonio 3801 from near Portobelo in Colón Province may also be this species. This collection differs in having more or less oblong blades, five to six times longer than broad that are narrowest midway and broader toward both the apex and the base. More material must be seen to determine its exact status.

DARIÉN: Cerro Sapo, *Hammel 1130* (MO, PMA), *1200* (MO).

Anthurium cineraceum Croat, sp. nov. TYPE: Colombia. Nariño: Pambaná, between Río Pimbí and Río Cuembí, on Río Telembí, above Barbacoas, ca. 50 m, ca. 1°35′N, 77°58′W (coordinates added), 3 Feb. 1945, *Ewan 16849* (US 2142808, holotype).

Planta terrestris aut epiphytica; internodii breve, 1.5–2 cm longi; fibrae cataphylli persistens; petioli (21–)43–75 cm longi; laminae profunde 3-lobatae, (25–)36–56 cm longae, plerumque siccitatae cinerascens; anguste obovato ad oblongo-elliptico lobo medio, apice acuminata; nervis primariis lateralis 7–14; falcato lobo lateralibus, (21–)31–43 cm longo, apice rotundato obtuse; pedunculus 8–30 cm longus; spatha linearo-lanceolata, viridis, 17–32 cm longa, 1.1–3 cm lata; spadix (13–)17–33 cm longus, 5–20 mm stipitatus, viridis ad lutea, violaceo purpurea maturitati; baccae ignotae.

Terrestrial or epiphytic; stem short, erect; internodes short, 1.5–2 cm long, turning reddish brown, persisting in a shredded condition or as naked fibers. LEAVES with petioles (21–)43–75 cm long, subterete, sulcate above at least near apex; geniculum 1–1.5 cm long; blades deeply 3-lobed to within 5–8 cm from the base, drying papyraceous, usually greenish gray, matte, (25–)36–56 cm long, weakly attenuate to broadly rounded at base; medial lobe narrowly obovate to oblong-elliptic, acuminate, broadest in the middle or distal two-thirds, 6.8–18 cm wide, broadly confluent with lateral lobes, primary lateral veins (medial lobe) 7–14, raised on both surfaces, especially on the lower surface, lower ones arising at ca. 60–70° angle, upper ones at ca. 30–40° angle, promptly curving upward and running nearly straight to the collective vein, interprimary veins few, collective vein arising from the lower one-third of blade, 3–6 mm from margin, sunken above, prominently raised beneath; reticulate veins drying conspicuously raised on lower surface; lateral lobes falcate (21–)31–43 cm long, 6–14 cm wide, bluntly rounded at the apex, inner margin weakly concave, outer margin broadly rounded; basal veins 3–4, 2–3 of them coalesced 4–5 cm; posterior ribs straight, forming a 90–130° angle with each other, not at all naked (weakly naked in Panamanian material). INFLORESCENCE with peduncle 8–30 cm long, terete; spathe spreading, linear-lanceolate, 17–32 cm long, 1.1–3 cm wide, green, drying brown, matte, caudate-acuminate at apex, decurrent 6–12 mm; spadix (13–)17–33 cm long, gradually tapered to apex, 6–10 mm diam. (dried), green to yellow at anthesis becoming violet purple; flowers rhombic, 7–12 per spiral, 2–2.4 mm long, 1.7–1.9 mm wide; lateral tepals 1.2–1.3 mm wide, inner margin broadly rounded; alternate tepals with inner margins concave; stamens not exserted. INFRUCTESCENCE not seen. Fig. 170.

Anthurium cineraceum occurs in eastern Panama and western Colombia in the Departments of Chocó and Nariño from near sea level to 950 m in tropical wet, premontane rain, and pluvial rain forest life zones.

The species is in section *Semaeophyllium* and is distinguished by its deeply trilobate leaf blades that dry grayish (hence the name *cineraceum* from cineraceous, meaning ash-grayish). It also lacks the naked posterior rib characteristic of *Anthurium garagaranum.*

Colombian material of the species is generally described as being terrestrial while Panamanian collections are epiphytic. Panamanian collections also differ in having blades that dry less decidedly grayish and may have the posterior rib briefly naked near the petiole.

Anthurium cineraceum is most easily confused with *A. garagaranum,* which differs in having spadices that dry semiglossy and blackened with more flowers per spiral (12–15). The leaf blades usually dry dark brown and have a prominently naked posterior rib along the edge of the sinus.

Anthurium cineraceum may also be confused with *A. insigne* Mast., another Colombian species with deeply three-lobed leaf blades, but the latter differs in having leaves that dry brown to reddish brown and stamens that are exserted at anthesis.

A juvenile plant (*Triana 1702*) collected in "Barbacoas i Chocó" at "Centra de Vívero" at 200 m in May 1933 is probably also this species.

DARIÉN: Cerro Pirre, summit 1,000 m, *Gentry 4602* (MO); N slopes, 300–700 m, *Mori & Kallunki 5358* (MO); between Tres Bocas & Cerro Campamento on Cana-Cuasí Trail, *Kirkbride & Duke 1347* (MO, NY), *1348* (NY).

Representative specimens from Colombia:

CHOCÓ: municipio of San José Palmar, Río Torito (branch of Río Hábita) at Finca "Los Guaduales," 730–830 m, *Forero et al. 6534* (COL, MO); Río Torito, 850–950 m, *Forero et al. 7385* (COL, MO); Río San Juan, 5 m, ca. 4°10′N, 77°10′W, *Forero & Jaramillo 4455* (COL, MO); Quibdó-Guayabal Road at Duata on Río Duata, 40 m, *Forero et al. 1268* (COL).

NARIÑO: Pambaná, above Barbacoas between Río Pimbí & Río Cuembí, on Río Telembí, 50 m, *Ewan 16849* (US).

Anthurium cinereopetiolatum Croat, sp. nov. TYPE: Panama. Panamá: Cerro Jefe, 21 km above Pan-American Hwy., ca. 600 m, *Croat 35868* (MO 2381198, holotype; NY, PMA, isotypes; Live at MO).

Planta epiphytica aut raro terrestris; cataphyllum 7–20 cm longum, friabilis, cadens intactum; petiolus 6–30 cm longus, subrotundatus; lamina anguste lanceolata-triangularis, basi lobatus, 20–55 cm longa, 6–20 cm lata. Inflorescentia effusa aut pendens, foliis breviora; pedunculus 12.5–25 cm longus, teres; spatha viridis pallide, interdum purpureo tincta, 6–14 cm longa, 1.6–2.5 cm lata, basi amplectens; spadix sessilis, viridis, 6–15 cm longus, basi 6–9 mm diam., apice 3–6 mm diam. Baccae ovoidae, purpurea, apice acutae.

Epiphytic or rarely terrestrial; stems elongate, to 20 cm or more, 1.5–2.5 cm diam.; gray-green; internodes 1–6 cm long, shorter near the stem apex; leaf scars 1–2 cm wide; roots several at some nodes, thick, branching; cataphylls medium thick, brittle, 7–20 cm long, acuminate at apex, with a subapical apiculum, drying tan, remaining intact and deciduous after drying. LEAVES erect-spreading to subpendent; petioles 6–30 cm long, 5–7 mm diam., flattened laterally, shallowly and sharply sulcate adaxially, rounded abaxially; geniculum 1.9–2.5 cm long, sometimes purplish, shaped like petiole; blades narrowly lanceolate-triangular, subcoriaceous, acute to gradually acuminate at apex, lobed at base, 20–55 cm long, 6–20 cm wide, broadest at base; anterior lobe 19–45 cm long, posterior lobes 1.5–12 cm long, directed outward and slightly upward, the sinus parabolic to triangular, rounded at apex; upper surface semiglossy; lower surface matte, obscurely punctate; midrib raised above, diminishing and sunken at apex, raised below; basal veins 4–6 pairs, the second to fourth coalesced 0.5–1 cm, sunken above, raised or flat below; posterior rib naked, the outer margin slightly upturned; primary lateral veins 9–30 per side, departing midrib at 45–60° angle, weakly raised in valleys above, flat below; collective vein arising from uppermost or second pair of basal veins, about as prominent as major lateral veins, 3–8 mm from the margin, sunken above, flat or slightly raised below. INFLORESCENCE erect-spreading, shorter than the leaves; peduncle 12.5–25 cm long, 5–7 mm diam.; terete, as long as to longer than petioles; spathe medium thick, pale green sometimes tinged purplish, narrowly lanceolate, 6–14 cm long, 1.6–2.5 cm wide, broadest at base, acuminate at apex, obtuse to clasping at base, inserted at 30–45° angle on peduncle; spadix sessile, green, 6–15 cm long, 6–9 mm diam. at base, 3–6 mm diam. at apex; flowers 4-lobed, 2–3.1 mm long, 2.3–2.9 mm wide, the sides jaggedly sigmoid, 4–10 flowers visible in the principal spiral, 7–12 flowers visible in the alternate spiral; tepals glossy, with droplets scattered

throughout before stamens emerge, the lateral tepals 1.2–1.6 mm wide, the inner margin straight to slightly convex; pistil not emergent before anthesis, pale green, very glossy; stigma ca. 0.3 mm long, linear, slightly indented; stamens emerging from base more or less rapidly, held in cluster over pistil when complete; anthers white, ca. 0.5 mm long, 0.8 mm wide, thecae ellipsoid, slightly divaricate; pollen white. INFRUCTESCENCE pendent, spathe green, reflexed, sometimes deciduous; spadix 12–31 cm long, ca. 2 cm diam.; berries pale red-violet to red, ovoid to oblong, pointed to narrowly rounded at apex, 6–9 mm long, 4–5 mm diam.; pericarp thin, with moderately conspicuous raphide cells; seeds 2, greenish white (?), flattened, more or less ellipsoidal, 2.5–3 mm long, 2–2.2 mm wide, 1–1.5 mm thick, enveloped completely in an ellipsoidal or obovoid gelatinous, transparent substance, 4–4.5 mm long. Fig. 51.

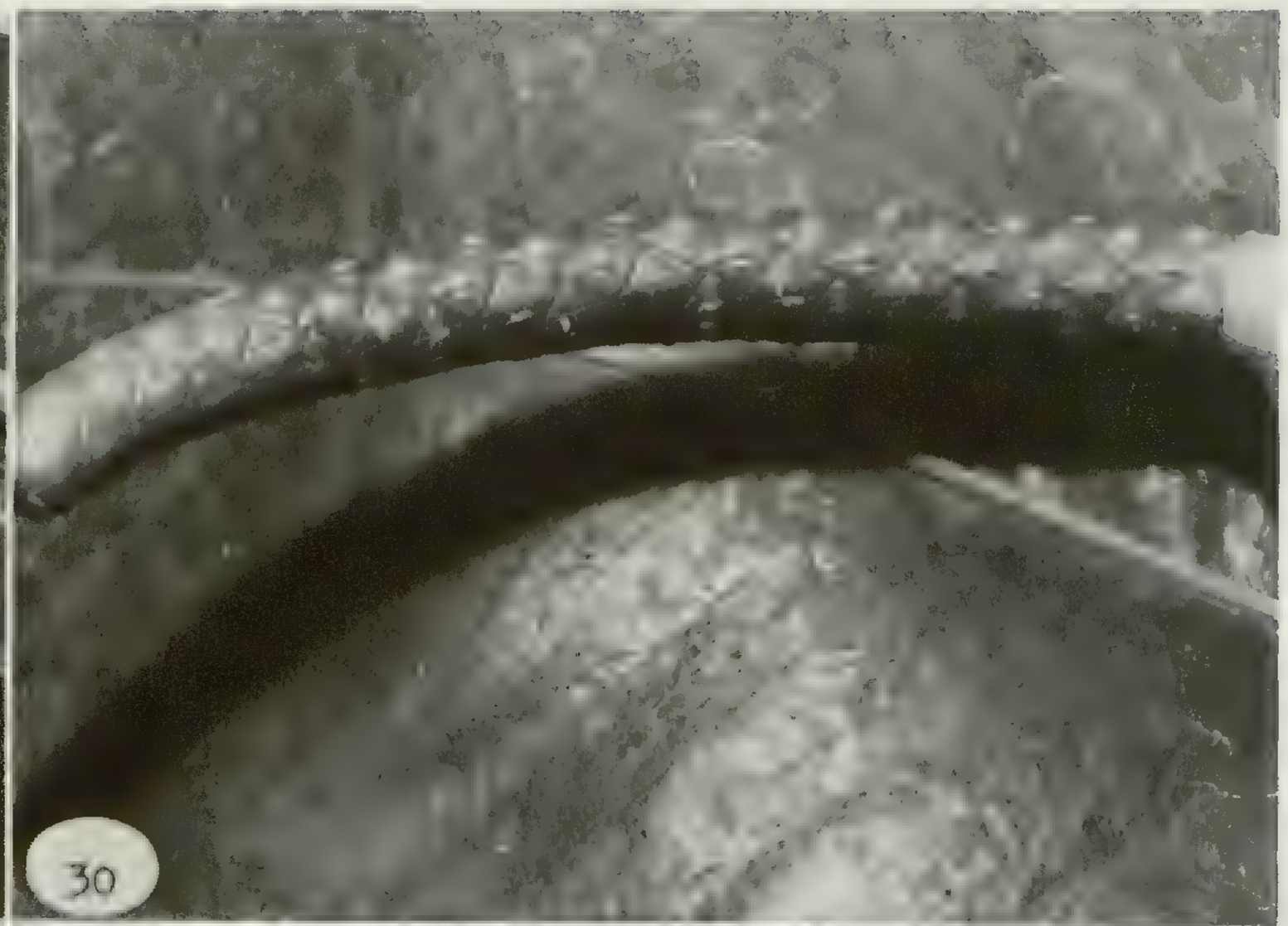
Anthurium cinereopetiolatum is known definitely only from central Panama east of the isthmus, where it inhabits tropical wet and premontane rain forest life zones at 600 to 1,000 m. A collection from Colombia, Department of Chocó (*Killip 35253*), is possibly this species, but the collection is sterile.

Sectional placement of *Anthurium cinereopetiolatum* is uncertain and it is tentatively placed in section *Belolonchium*. This species is closest to *A. hebetatum,* which has a similar thick, persistent cataphyll, a slender, more or less elongated stem, coriaceous leaf blades, a greenish spadix and spathe, and reddish berries. Both species also have grayish cataphylls and petioles (hence the name *cinereopetiolatum*). *Anthurium cinereopetiolatum* differs from *A. hebetatum,* however, in having a narrowly triangular or ovate-triangular blade (broadest at the base) with the posterior lobes sometimes turned weakly outward. The blades of *A. hebetatum* are almost oblong and usually broadest well above the base. The posterior lobes are poorly developed or lacking. In addition, the upper blade surface of *A. cinereopetiolatum* is semiglossy, whereas in *A. hebetatum* the blade surface is matte.

PANAMÁ: vicinity Cerro Jefe, *Almeda & Nakai 3448* (CAS), *Correa 563* (MO), *Croat 35868* (MO, NY, PMA), *49089* (MO), *Folsom & Page 5933* (MO), *Gentry et al. 3502, 3503* (MO), *Mori et al. 3780* (MO), *Plowman & Weil 3155* (K); NE of Altos de Pacora, *Croat 22726* (F, MO, PMA), *Mori & Kallunki 6053* (MO).

Anthurium circinatum Croat, Selbyana 5: 317. 1981. TYPE: Panama. Chiriquí: above San Félix along mining road, 18–27 mi. off the Pan-American Hwy., 1,200–1,500 m, *Croat 33102* (MO 2389002, holotype; K, PMA, isotypes; Live at MO).

Epiphytic or terrestrial; stems to 30 cm long, ca. 1.5 cm diam.; leaf scars ca. 8 mm wide; roots few, descending, ca. 3 mm diam.; cataphylls medium thick, 3–5 cm long, acuminate, drying light brown (B & K Yellow 5/5), weathering to stiff brown fibers, persisting in the existing leaf axils and a few of the leafless axils. LEAVES spreading; petioles 6–39 cm long, 2–5 mm diam.; terete or weakly sulcate, minutely speckled; geniculum 6–11 mm long, shaped like the petiole; blades narrowly ovate-oblong or rarely elliptic-oblong, coriaceous, sometimes arched along the midrib, downturned and acuminate at apex, rounded to obtuse at base, 13–33 cm long, 2–11 cm wide, broadest just below the middle, the margin straight and flat; upper surface matte, sunken glandular-punctate, lower surface glossy to semiglossy, minutely and densely glandular-punctate; midrib narrowly and prominently raised almost to the apex above, then abruptly sunken, paler than surface, flat or prominulous and paler below; primary lateral veins 6–12 per side, departing midrib at ca. 45° angle, sunken above and below, more or less straight to the collective vein, drying prominulous on both surfaces; all lesser veins obscure above, slightly visible below; interprimary veins less obscure on drying; collective vein arising from the base, mostly 3–7 mm from the margin. INFLORESCENCE spreading or erect-spreading, shorter than the longest leaves; peduncle 7–34 cm long, 1–3 mm diam., flexible, usually shorter than petioles, rarely longer; spathe chartaceous, pale green tinged purplish, oblong-lanceolate to ovate, 2.5–7 cm long, 6–10 mm wide, broadest at the base, short-acuminate at apex (the acumen hooked), rounded to subcordate at base, the margins sometimes turned under, inserted at 10° angle on peduncle; stipe 3–15 (rarely to 30) mm long, ca. 2 mm diam., green, sometimes tinged reddish; spadix light brown usually twisted like a corkscrew at maturity, 4.5–23.7 cm long, 4–5 mm diam. midway, 3–4 mm diam. near apex; flowers rhombic to 4-lobed, 2.8–3.2 mm long, 3–4.2 mm wide, the principal spiral usually with 2–3 flowers visible, 6–7 flowers visible in the alternate spiral, the sides adjacent to the spirals straight, the sides



FIGURES 29–32. 29, 30. *Anthurium cartiense* Croat , *Croat 33803.*—31. *Anthurium caloveboranum* Croat, *Croat 25803.*—32. *Anthurium colonicum* K. Krause, *Croat 33640.*

perpendicular to the spirals slightly sigmoid; tepals matte, minutely papillate, the lateral tepals 2.7–3.3 mm wide, the inner margin slightly concave; pistils pale green, glossy, weakly protruding, the stigma linear, ca. 0.5 mm long; lateral stamens emerging more or less rapidly and irregularly from base to apex before alternate stamens have emerged to middle, weakly exserted on short, fleshy filaments, retracted and held at the edge of the pistil in a tight circle, the anthers pale yellow, ca. 0.3 mm long, 0.6 mm wide, the thecae broadly ellipsoid, slightly divaricate; pollen white. INFRUCTESCENCE more or less pendent, the spathe deciduous, the spadix 15–41 cm long; berries globose to depressed-globose, red, ca. 8 mm long. Figs. 35 and 36.

The species is known only in Chiriquí Province in lower montane rain forest at elevations from 1,200 to 1,700 m.

Anthurium circinatum is in section *Porphyrochitonium* and is most closely related to *A. chiriquense* with which it shares similar flowers with lateral tepals substantially wider in the direction of the axis than perpendicular to the axis. The latter differs in having larger leaves that are acute at the base and narrowly elliptic, 8–12 cm wide and 32–38 cm long. Those of *A. circinatum* are mostly rounded at the base, narrowly ovate, and usually less than 8 cm wide or, if broader, they are less than 30 cm long (rarely the leaves larger as in *Croat 37151*).

The species is distinguished by its narrowly ovate to ovate-oblong leaves with the midrib beneath, scarcely or not at all raised, by the red, depressed-globose berries that are beaked at the apex, and by the light brown spadix that is twisted in a coiled manner and becomes corkscrew-like.

Although less closely related to *Anthurium circinatum* than is *A. chiriquense, A. longistipitatum* has been confused with *A. circinatum. Anthurium longistipitatum* was not discovered until after publication of *A. circinatum* and was included with it in the type description. Thus, that description should be disregarded in preference to the descriptions prepared in this treatment. Plate 6 representing a flowering specimen in the original article (Selbyana 5: 321. 1981), is actually *A. longistipitatum* whereas Plate 2, showing an infructescence, is *A. circinatum.* Both species have persistent, disoriented cataphyll fibers, have coriaceous, glandular-punctate blades that are matte above and semiglossy beneath, and both have the upper midribs prominently raised and the lower midrib nearly flat. However, flowering material is distinctly different. *Anthurium circinatum* has shorter, thicker spadices with matte, light brown flowers that are larger than those of *A. longistipitatum* and broader than long. In contrast, *A. longistipitatum* has generally longer, more slender spadices with glossy, dark reddish brown to violet purple flowers that are about as broad as long. *Anthurium circinatum* has dried lateral tepals that are thin marginally and more than two and a half times broader in the direction of the axis than perpendicular to the axis, whereas in *A. longistipitatum* they are thick marginally and less than two times broader in the direction of the axis.

Additional specimens of both species show the leaves to be different as well; those of *A. circinatum* are two and a half to five times longer than broad, most commonly narrowly ovate with usually six to 12 primary lateral veins, whereas those of *A. longistipitatum* are mostly oblong-linear, six to ten times longer than broad with usually 12–20 primary lateral veins.

Anthurium circinatum is superficially similar to *A. louisii* Croat & Baker from Costa Rica, which has inflorescences with a similar tendency to spiral in a corkscrew fashion (hence the name *circinatum*) and which also has flowers with tepals turned markedly upward on flowering thus giving the spadix a markedly asperous look. However, that species has broadly ovate leaves and thick margined tepals that are not elongate in the direction of the axis of the spadix.

BOCAS DEL TORO: NW ridge of Cerro Pata de Macho, *Sytsma et al. 4967* (MO).

CHIRIQUÍ: end of road to Bajo Mono, *Folsom et al. 2248, 2249* (MO); Cerro Colorado, *Antonio 1421, 1512* (MO), *Croat 33270* (MO, PMA), *37151, 48462* (MO), *Folsom & Collins 1773* (MO), *Folsom et al. 4705* (MO), *Mori & Dressler 7844* (MO), *Sullivan 398* (MO); SE slopes & summit of Cerro Pata de Macho, *Sytsma et al. 4895* (MO, NY); Palo Alto, NE of Boquete, *Hammel 5711, 7467* (MO); above San Félix, *Croat 33102* (K, MO, PMA), *Mori & Kallunki 5872* (F, MO, PMA), *5990* (MO).

Anthurium clavigerum Poepp. in Poepp. & Endl., Nov. Gen. Sp. Pl. 3: 84. 1845. TYPE: Peru. Pampayacu, *Poeppig 1423* (W, not seen; F, photo).

Anthurium panduratum Mart. ex Schott, Oesterr. Bot. Wochenbl. 5: 273. 1855. TYPE: Brazil. Río Negro, *Martius 3115* (M, not seen; US, photo).

Anthurium holtonianum Schott, Oesterr. Bot. Wo-

FIGURES 33–36. 33. *Anthurium colonicum* K. Krause, *Croat 25831.*—34. *Anthurium cuasicanum* Croat, *Kirkbride & Duke 1267.*—35, 36. *Anthurium circinatum* Croat, *Croat 33102.*

chenbl. 7: 317. 1857. TYPE: Colombia. La Paila, *Holton s.n.* (K, not seen; SEL, photo).

Anthurium repandum Schott, Oesterr. Bot. Wochenbl. 7: 317. 1857. TYPE: Colombia. Santa Marta, *Purdie s.n.* (K, not seen; SEL, photo).

Anthurium wendlandii Schott, Oesterr. Bot. Z. 8: 182. 1858. TYPE: Costa Rica. San Miguel, *Wendland 957* (GOET, illustrated by Schott Aroid Drawing #827; W, not seen; F, SEL, US, photos).

Anthurium kalbreyeri N. E. Brown, Gard. Chron. 16: 117. 1881. TYPE: Colombia. Antioquia, *Kalbreyer s.n.* (K, not seen).

Anthurium burchellianum (Engl.) Macbr., Field Mus. Nat. Hist., Bot. Ser. 11: 7. 1931. *Anthurium pandurata* var. *burchellianum* Engl., Pflanzenr. 4(23B): 279. 1905. TYPE: Brazil. Pará, *Burchell 9632* (K, not seen).

Anthurium obovatum Gleason, Bull. Torrey Bot. Club 56: 9. 1929. TYPE: British Guiana. Kopinang River, Anandabaru, *Alston 475* (K, not seen; F, photo).

Anthurium monsteroides Steyerm., Fieldiana, Bot. 28: 93. 1951. TYPE: Venezuela. Mérida: Río Onia near Bolero, N of Mesa Bolívar, *Steyermark 56727* (F).

Epiphyte; scandent; stems 2 m long, 3–5 cm diam., cataphylls weathering to medium brown fibers, ultimately deciduous; petiole 65–150 cm long, terete or weakly sulcate; blades digitately compound, to 2 m wide, the leaflets 25–100 cm or more long, 4–12 cm wide, sinuate or lobate. Inflorescence arching-pendent; peduncle to 90 cm long, terete; spathe coriaceous, violet purple, lanceolate, 30–65 cm long, 3–11 cm wide; spadix lavender purple, 20–75 cm long, to 2 cm diam. at base; berries purple, obovoid, developing in basal portion only, seeds 1–2. See Croat (1983: 276) for a more complete description.

Anthurium clavigerum is found from Nicaragua to the Guianas, Brazil and Bolivia. In Panama the species occurs in premontane moist and tropical moist forest from sea level to 700 m. It has also been collected reportedly at 1,000 m in what is apparently lower montane wet or lower montane rain forest.

The species is not confused with any other in Central America and can be recognized by its pedatisect leaves with sinuate to lobed margins and by its huge pendent inflorescence. The species may have leaf blades up to about 2 m broad, making it the largest species of *Anthurium* in Central America. It is a member of section *Dactylophyllium* and is most closely related to *A. sinuatum* Benth. ex Schott of South America.

BOCAS DEL TORO: between Almirante & Ojo del Agua, *Croat 38230* (MO), *Lewis et al. 5577* (MO).

CANAL ZONE: Barro Colorado Island, *Aviles 26* (MO), *Bailey & Bailey 208* (BH), *Croat 4004A, 4230, 4654, 5154, 6552, 6659, 7103, 7202, 7935, 8328, 8784, 11008, 11701, 12566, 12661* (MO), *Foster 1449* (DUKE), *Graham 329* (MICH), *Knight 14* (WIS), *Shattuck 289* (MO), *Woodworth & Vestal 554* (MO); Cerro Galera, *Gentry 6665* (MO); Chagres, *Fendler 428* (MO); S of Colón on Río Providencia, *Tyson & Blum 3976* (MO); vicinity crossing of Cruces Trail & Madden Dam Road, *Bartlett & Lasser 16438* (MICH, MO); along road from Fort Sherman to Gatún Locks, *Tyson & Blum 3810* (MO); Las Cascadas, *Dodge & Hunter 8659* (MO); Quebrada Salamanca, *Dodge et al. 17010* (BR, MO, S); NW of Summit Gardens, *Nee 6939* (MO).

CHIRIQUÍ: Burica Peninsula, W of Puerto Armuellas, *Busey 606* (MO), *Liesner 92* (MO).

COCLÉ: between Continental Divide, El Copé & El Potroso, *Sytsma et al. 2418* (MO); forest around Limón, N of Alto Calvario, *Folsom 5850* (MO).

COLÓN: E of Buena Vista, *Nee 7780* (RSA, MO); Río Guanche, *Croat 36944* (MO); Santa Rita Trail, *Cowell 164* (NY).

DARIÉN: Boca de Cupe, *Williams 961* (NY); vicinity gold mine at Cana, *Croat 37638* (MO); vicinity Canglón, *Antonio 4567* (MO); S of El Real, *Hartmann 12040* (MO); road from El Real to Pinogana, *Duke 5156* (MO); Río Púcuro between Cerro Mali & Cerro Tacarcuna, *Gentry & Mori 13914* (MO).

PANAMÁ: mountain above Tortí Arriba, *Folsom et al. 5093, 6721* (MO); S of Alcalde Díaz, *Nee 8572* (MO, RSA); Cerro Campana, *Hutchinson 2968* (UC), *Sheffer 146* (MO); Cerro Jefe, *Wilbur et al. 15563* (DUKE); Gorgas Memorial Laboratory NE of Cerro Azul, *Mori & Kallunki 3387* (MO); El Llano-Cartí Road, *Folsom 1441* (MO), *Luteyn 4122* (DUKE); N of El Llano near San Blas border, *Gentry 5790* (MO); La Charrera, *Paul 502* (MICH).

SAN BLAS: along the Aila Tiwar, *Sugden 392* (MO).

Anthurium coclense Croat, Selbyana 5: 321. 1981. TYPE: Panama. Coclé: La Mesa N of El Valle de Antón, ca. 2 km W of Cerro Pilón, on slopes of steep hill, disturbed virgin forest, 860–900 m, 21 July 1976, *Croat 37373* (MO 2395383, holotype; B, CAS, F, GH, K, NY, PMA, SEL, US, VEN, W, isotypes; Live at MO).

Usually epiphytic, frequently terrestrial, weakly rooted, 0.5–1.5 m tall; stem elongate, 30–75 cm long, 6–25 mm diam., dark olive green, minutely fissured, turning grayish green; internodes 1–5 cm long; roots few at each node, scaley; cataphylls moderately thin, 6–15 cm long, apiculate at apex, drying yellowish (B & K Yellow 9/2.5), remaining intact or weathering and soon deciduous. LEAVES with petioles (3–)5–57 cm long, 4–9 mm diam., terete to oval, flattened to bluntly sulcate near apex; geniculum 1.5–4 cm long, shaped like the petiole with sharper edges; blades oblong-oblanceolate to elliptic or ovate-elliptic, moderately thin, gradually long-acuminate at

apex to abruptly acuminate (the acumen flat, acicular at apex, sometimes downturned), obtuse to narrowly rounded or weakly lobed at base, (18–)28–51 cm long, (3–)10–26 cm wide, broadest above the middle, the larger blades sometimes noticeably inequilateral with one side to 3 cm narrower than the other; both surfaces semiglossy; midrib obtuse at base above, becoming more acute, diminishing and sunken at apex, paler than surface, sharply raised below, paler than surface; primary lateral veins 6–16 per side, departing midrib at 40–50° angle, straight to arcuate-ascending to collective vein, sunken or weakly raised in valleys above, raised below; interprimary veins few, mostly continuous to the collective vein, sunken above, raised below; collective vein arising from one of the lowermost primary lateral veins, sometimes higher, mostly 3–10 mm from margin. INFLORESCENCE spreading-erect, much shorter than leaves; peduncle 3–35(–50) cm long, 2.5–5 mm diam., subquadrangular, striate, flat to rounded adaxially, the ridges closer and more prominent abaxially, one-fourth to one-half as long as petioles; spathe subcoriaceous, green (B & K Green 7/2.5 to Yellow-green 5/5) at anthesis, both spathe and peduncle sometimes heavily tinged with purple, usually reflexed, narrowly lanceolate to ovate-oblong, 1.5–7 cm long, 0.9–2.5 cm wide, broadest slightly below the middle, abruptly acuminate at apex, rounded at base, inserted at 45° angle on peduncle; stipe to 5 mm long; spadix green to dark green (B & K Yellow-green 5/7.5 to Green 5/5) at anthesis, 2–10.5 cm long, 3–7 mm diam. at base, 2–6 mm diam. at apex, flowers 4-lobed, 2–2.4 mm long, 2.4–2.8 mm wide, the sides jaggedly sigmoid, ca. 10 flowers visible in the principal spiral, ca. 7 flowers visible in the alternate spiral; tepals semiglossy, minutely papillate, darker along the outer margins, weakly punctate or epunctate, with scattered droplets, the lateral tepals 1–1.3 mm wide, the inner margins turned up against the pistil, the outer margin 3- or 4-sided; pistil emergent ca. 0.5 mm before anthesis; stigma round, minutely brush-like, with a minute droplet briefly apparent several days before first stamens emerge; stamens emerging one at a time in a scattered pattern beginning near the base, exserted 0.7–0.8 mm above the tepals; filaments fleshy, transparent, the exposed part longer than the anther, narrowly acute; anthers held erect, 0.4–0.5 mm long, 0.4–0.6 mm wide, pale yellow, widely spaced; thecae scarcely divaricate, oblong-elliptic, opening flat; pollen pale yellow (B & K Yellow 9/5) fading white. INFRUCTESCENCE spreading; spathe persisting, to 8 cm long; spadix to 15 cm long, 2 cm diam.; berries ovoid, acute at apex, reddish becoming dark purple-violet, to 7.5 mm long, 5 mm wide; seeds 2, ovoid-ellipsoid, brown (B & K Yellow 4/2.5), weakly flattened, 3.2–3.8 mm long, 2.2–2.5 mm wide, 1.3–1.5 mm thick. Figs. 19, 20, and 22.

The species is known only from central Panama at elevations of 500 to 1,100 m in regions of tropical wet and premontane rain forest.

It is recognized by its erect, elongate stem, the oblong blades, broadest above the middle and usually narrowly rounded or subcordate at base, the short inflorescence with quadrangular or striate peduncles, and the greenish oblong spadix with pale yellow to whitish pollen. It is seemingly unrelated to any other species in Central America, and no South American relatives are known. It is tentatively placed in section *Xialophyllium*.

COCLÉ: Alto Calvario, *Croat 49199* (MO), *Folsom & Jaslon 2678* (MO); between Caña Sucio & waterfall at base of Cerro Tife, *Sytsma et al. 2510* (MO); Cerro Gaital Caracoral, *Dwyer & Correa 8894* (SCZ); Cerro Pilón, *Mori 6584* (MO), *Porter et al. 4373, 4378* (MO); vicinity El Copé, *Hammel 3467, 3518* (MO); El Valle de Antón, *Folsom 3121* (MO), *Kennedy et al. 3185* (MO), *Luteyn 1147, 1239* (DUKE), *Luteyn & Kennedy 1642, 1647* (DUKE), *1735* (DUKE, MO); area between La Junta & Limón, *Folsom 5874* (MO); La Mesa, *Croat 13434, 25363* (MO), *37373* (B, CAS, F, GH, K, MO, NY, PMA, S, SEL, US, VEN, W), *Kennedy & Dressler 1743* (MO), *Luteyn 4080* (DUKE), *Sullivan 447* (MO), *Sytsma et al. 4345* (MO), *Wilbur et al. 15657* (DUKE); vicinity Llano Grande, *Antonio 1376* (MO), *Sytsma et al. 4411* (MO); Continental Divide N of Penonomé, *Hammel 4017* (MO); Atlantic slope along Río San Juan, *Hammel 3461* (MO).

COLÓN: Coclé del Norte, *Hammel 4520* (MO); below Cerro Bruja, along Río Escandaloso, *Kress & Knapp 82-1395* (DUKE).

PANAMÁ: El Llano-Cartí Road, *Folsom et al. 1452* (MO), *Folsom & Skog 2460* (MO), *Nee & Dressler 9386* (M, MO); Serranía de Cañasas, above Tortí Arriba, *Folsom et al. 6745* (MO).

VERAGUAS: between Escuela Agricola Alto Piedra & Río Calovébora, *Croat & Folsom 34144* (F, MO, PMA), *Croat 48989* (MO).

Anthurium collinsii Croat, sp. nov. TYPE: Panama. Panamá: Serranía de Cañasas, vicinity Rancho Chorro above Tortí Arriba, 400–700 m, *Folsom & Collins 6676* (MO, holotype; K, PMA, isotypes).

Planta terrestris, cataphyllum persistens in fibris tenuibus; petiolus teres, 18–21 cm longus; lamina ovata,

modice membranacea, basi rotundata ad plus minusve subcordata, 13–15 cm longa, 8–9 cm lata, utrinque glanduloso-punctata, inflorescentia foliis breviora; pedunculus 14–16 cm longus; spatha membranacea, rubescens, lanceolata, ca. 2 cm longa, 6–8 mm lata; spadix rubescens, 3–4 cm longus; baccae globosae, purpureae.

Terrestrial; stems elongate, 10 cm or more long; leaf scars obscured by persistent cataphylls, cataphylls 2.5–3 cm long, drying medium brown, weathering into fine fibers. LEAVES erect-spreading; petioles 18–21 cm long, 2–3 mm diam., terete; blades ovate, moderately thin; long-acuminate at apex, rounded to weakly subcordate at base, 13–15 cm long, 8–9 cm wide; both surfaces semiglossy, glandular-punctate; midrib raised above and below (dry); primary lateral veins 10–12 per side, departing midrib at 45–50° angle, prominulous above and below (dry); interprimary veins visible above, obscure below (dry); collective vein arising from near the base, 6–7 mm from margin, raised above and below, loop-connecting primary lateral veins, forming an acute angle with margin near apex. INFLORESCENCE shorter than leaves; peduncle 14–16 cm long, 1–2 cm diam., shorter than petioles; spathe reddish, thin, lanceolate, ca. 2 cm long, 6–8 mm wide, acuminate at apex, acute at base; spadix reddish, 3–4 cm long, ca. 3 mm diam. at base, 2 mm diam. at apex, the sides sigmoid, 3–4 flowers visible in the principal spiral, 4–5 flowers visible in the alternate spiral; tepals semiglossy, lateral tepals 0.4–0.6 mm wide, the inner margins convex; pistils emergent; stigmas exserted, brush-like; stamens exposed just above tepals; anthers persisting after anthesis, ca. 0.2 mm long, ca. 0.5 mm wide; thecae ovoid, slightly divaricate. INFRUCTESCENCE with berries (immature) globose, purplish in upper half, greenish in lower half; mesocarp with numerous punctiform, whitish raphide cells; seeds (immature) 4, oblong, light brown, 2 mm long, 1 mm wide, conspicuously flattened, slightly tapered toward apex (point of attachment), rounded at base, enveloped in a flattened, transparent sack that is longer and broader than the seed itself. Fig. 26.

Anthurium collinsii is endemic to Panama in the Serranía de Cañasas in southeastern Panamá Province at 400 to 700 m. The species is known only from the type collection, probably collected in tropical wet forest but possibly in premontane rain forest.

Anthurium collinsii is a member of section *Porphyrochitonium* and is distinguished by its terrestrial, vine-like habit, its slender stems with old cataphyll fibers persisting at the nodes, its terete petioles longer than the blades, its ovate, abruptly long-acuminate, glandular-punctate blades with a single collective vein, and especially by its reddish spathe and spadix.

It is most closely related to *Anthurium subrotundum* of the Serranía de Pirre near the Colombian border. That species differs in having blades essentially rounded at the apex and green to white spadices. *Anthurium collinsii* is also related to *A. melastomatis,* a species endemic to the province of Coclé near El Copé. The latter differs in having more narrowly ovate leaves with three collective veins.

The species is named in honor of Leo Collins, one of the collectors of the type specimen.

PANAMÁ: mountains above Tortí Arriba, *Folsom et al. 6676* (K, MO, PMA).

Anthurium colonense Croat, sp. nov. TYPE: Panama. Coloń: Río Guanche above bridge on Portobelo Road, ca. 3–5 km above bridge, 50–200 m, *Croat 36959* (MO 2395448–50, holotype; B, F, K, NY, PMA, SEL, US, VEN, isotypes; Live at MO).

Planta epiphytica; caudex usque 20 cm longus; cataphyllum coriaceum, persistens intactum, denique deciduum; petiolus camplanatus ad anguste et dilute sulcatus; lamina ovata, subcoriacea, basi profunde cordata, 31–99 cm longa; 21–74 cm lata; inflorescentia erecta aut effusa; pedunculus subteres, 18–38 cm longus; spatha subcoriacea, pallide viridis, lanceolata ad oblongo-lanceolata, 20–37 cm longa, 4–6 cm lata; spadix luteo-viridis, 28.3–48 cm longus; baccae aurantiacae, anguste obovoideae, 1.5–1.6 mm longae.

Epiphyte; stems to 20 cm long, ca. 5 cm diam.; leaf scars 4–4.5 cm wide; roots thick, green, more or less smooth, descending; cataphylls coriaceous 21–27 cm long, acute at apex (the acumen apiculate), sometimes splitting at base while still fresh, drying brown (B & K Yellow 3/7.5), the apex persisting intact, splitting at base, ultimately deciduous. LEAVES erect to spreading; petioles 32–98 cm long, 1–1.5 cm diam., subterete, sometimes weakly flattened to narrowly and shallowly sulcate; geniculum 3–5 cm long; blades ovate, moderately thick, abruptly acuminate at apex, deeply lobed at base, 31–99 cm long, 21–74 cm wide, broadest at middle or just below; anterior lobe 27–56 cm long, the margins rounded; posterior lobes 9–20 cm long from apex of sinus to outermost point; sinus hippocrepiform to spathulate, acute to rounded at apex; both surfaces

semiglossy; midrib acutely raised above and below, yellowish below; basal veins 6–9 pairs, first, second and sometimes third free to base, those remaining coalesced 3.5–4.5 cm, raised above and below, posterior ribs turned up, naked; primary lateral veins 3–7 per side, departing midrib at 45–50° angle, raised at midrib, sunken near collective vein above, raised below; interprimary veins flat to weakly sunken above, raised below, secondary veins flat above and below; collective vein arising from one of the primary lateral veins in the upper half of the blade, 1–1.3 cm from the margin, flat to weakly sunken above, prominulous below. INFLORESCENCE erect to spreading, shorter than leaves; peduncle 18–38 cm long, 0.6–1 cm diam., subterete; spathe subcoriaceous, pale green (B & K Yellow-green 8/10), lanceolate to oblong-lanceolate, 20–37 cm long, 4–6 cm wide, broadest just above base, long-acuminate at apex, acute at base, inserted at 45° angle on peduncle; spadix yellow-green (B & K Yellow-green 8/7.5), 28.3–48 cm long, 1.3–2 cm diam. near base, 5–7 mm diam. near apex; flowers rhombic to 4-lobed, 2.7–3.7 mm long, 2.5–3 mm wide, the sides straight to sigmoid, 8–12 flowers visible in the principal spiral, 6–8 flowers visible in the alternate spiral; tepals glossy, minutely and densely papillate, lateral tepals 1–2.2 mm wide, the inner margin convex; pistils weakly raised, green; stigma linear; stamens not emerging, pollen oozing out in long, flat ribbons, beginning at the base, pollen yellowish fading to white. INFRUCTESCENCE pendent; berries orange (B & K Yellow-red 8/7.5), narrowly obovoid, acute at apex, 1.5–1.6 mm long, 4.3 mm diam. at base, 1.4 mm diam. at apex; mesocarp orange, gelatinous; seeds 2, green tinged brownish at base and apex, ovoid, ca. 0.5 mm long, 0.2 mm wide, both ends with a sticky, clear appendage. Figs. 41 and 42.

Anthurium colonense is endemic to Panama in the Provinces of Veraguas, Coclé, Colón, Darién, and the Canal Zone from sea level to 1,500 m. It is found in tropical wet and lower montane wet forest life zones.

The species is probably the largest member of section *Calomystrium* occurring in Panama and is recognized by its moderately thick, ovate blades, its long tapered spadix that has no stamens emerging but oozes pollen in flat ribbons. It is also recognized on drying by its blackish color.

Anthurium colonense is similar to the larger plants of *A. curvispadix* but that species has a somewhat longer peduncle, a shorter spadix, and has not been known to dry blackish as does *A. colonense*.

CANAL ZONE: Mojinga Swamp, *Bartlett & Lasser 16860* (MICH, MO); S of Colón, *Tyson et al. 4498* (MO, SCZ).

COCLÉ: S of Penonomé, *Hammel 1675* (MO); road between La Pintada & Coclecito, *Croat 49238* (MO).

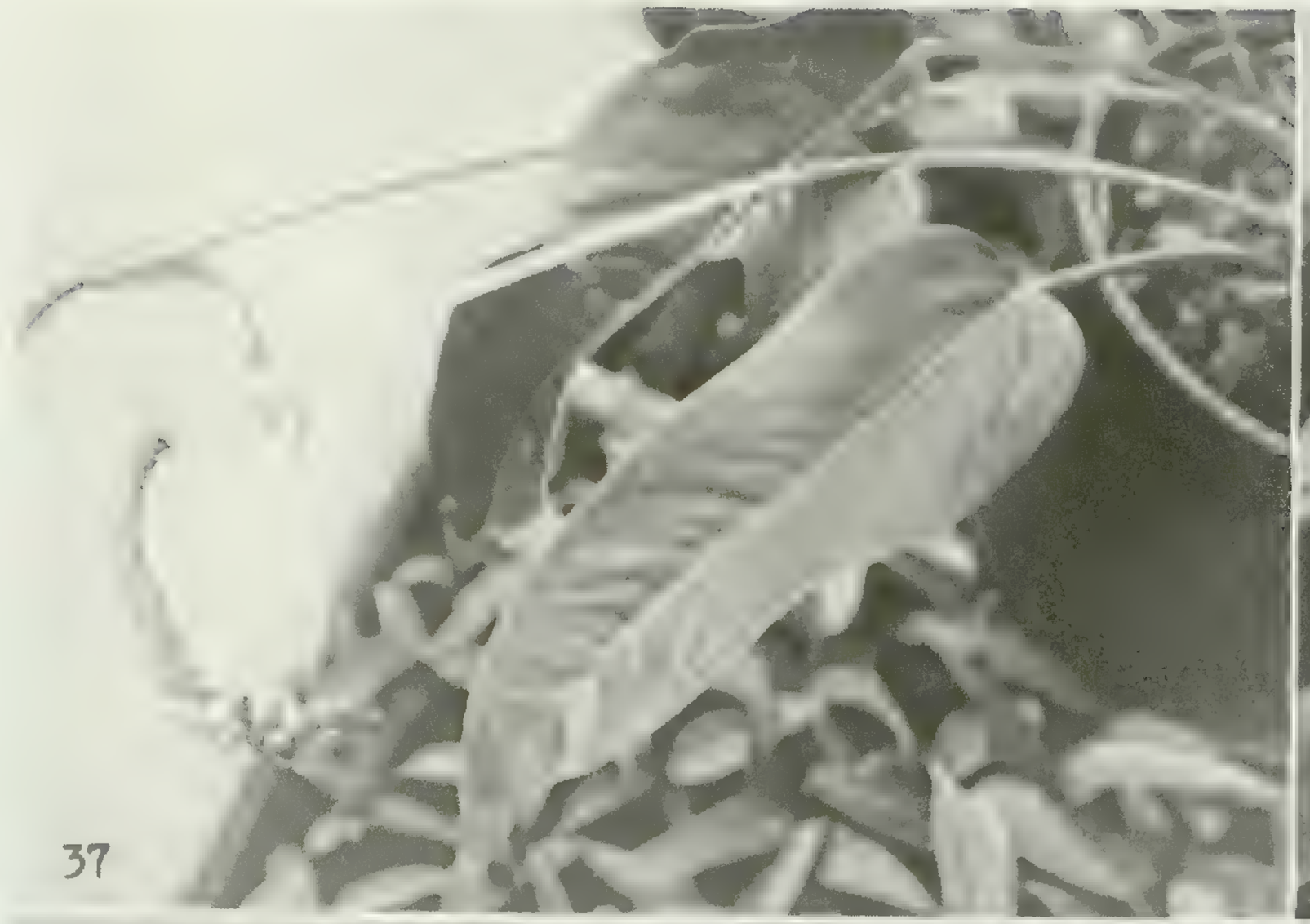
COLÓN: Río Guanche, *Croat 36959* (B, F, K, MO, NY, PMA, SEL, US, VEN); Río Iguanita, *Croat 49747* (MO).

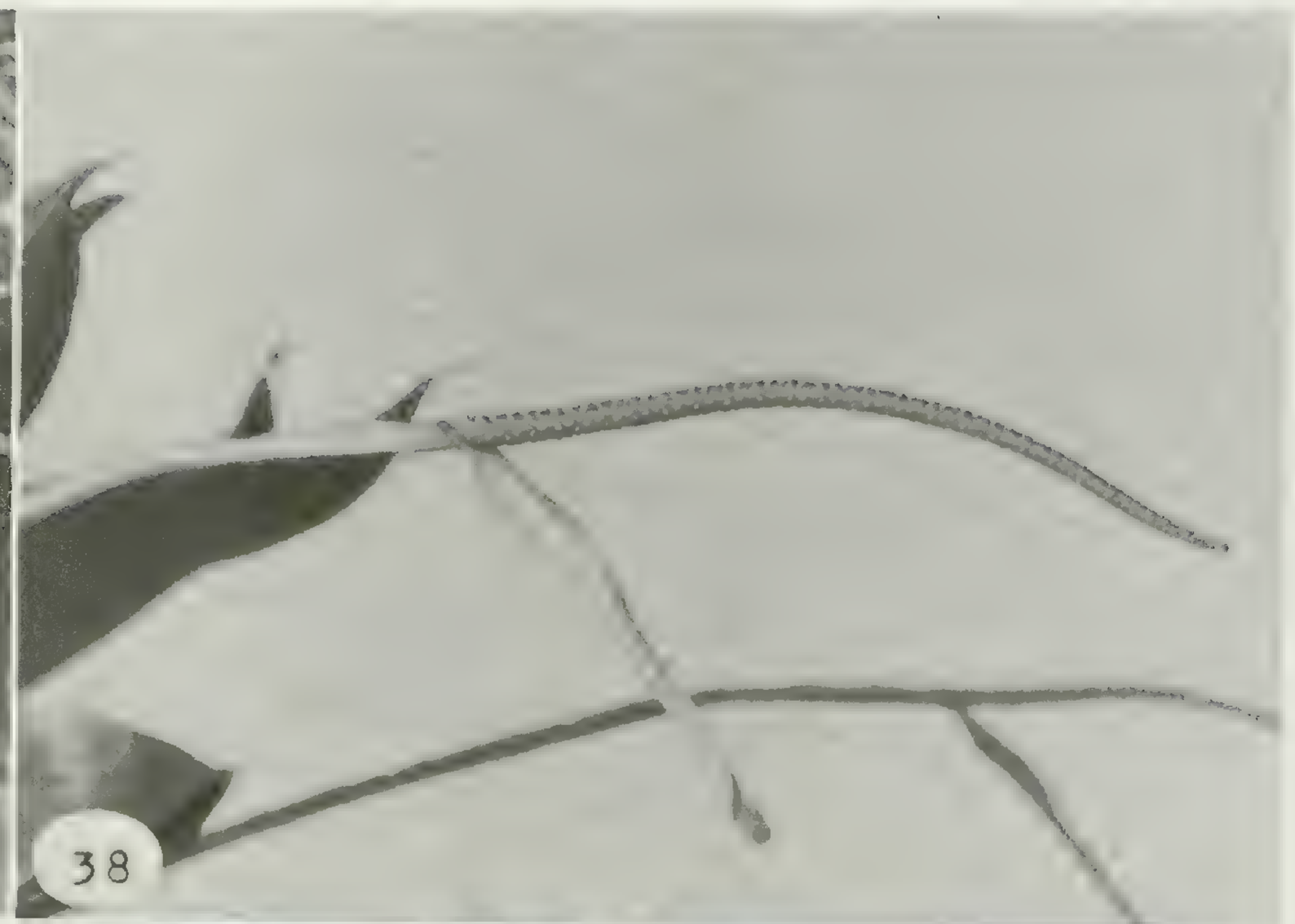
DARIÉN: Serranía de Pirre, *Croat 37882, 37896* (MO).

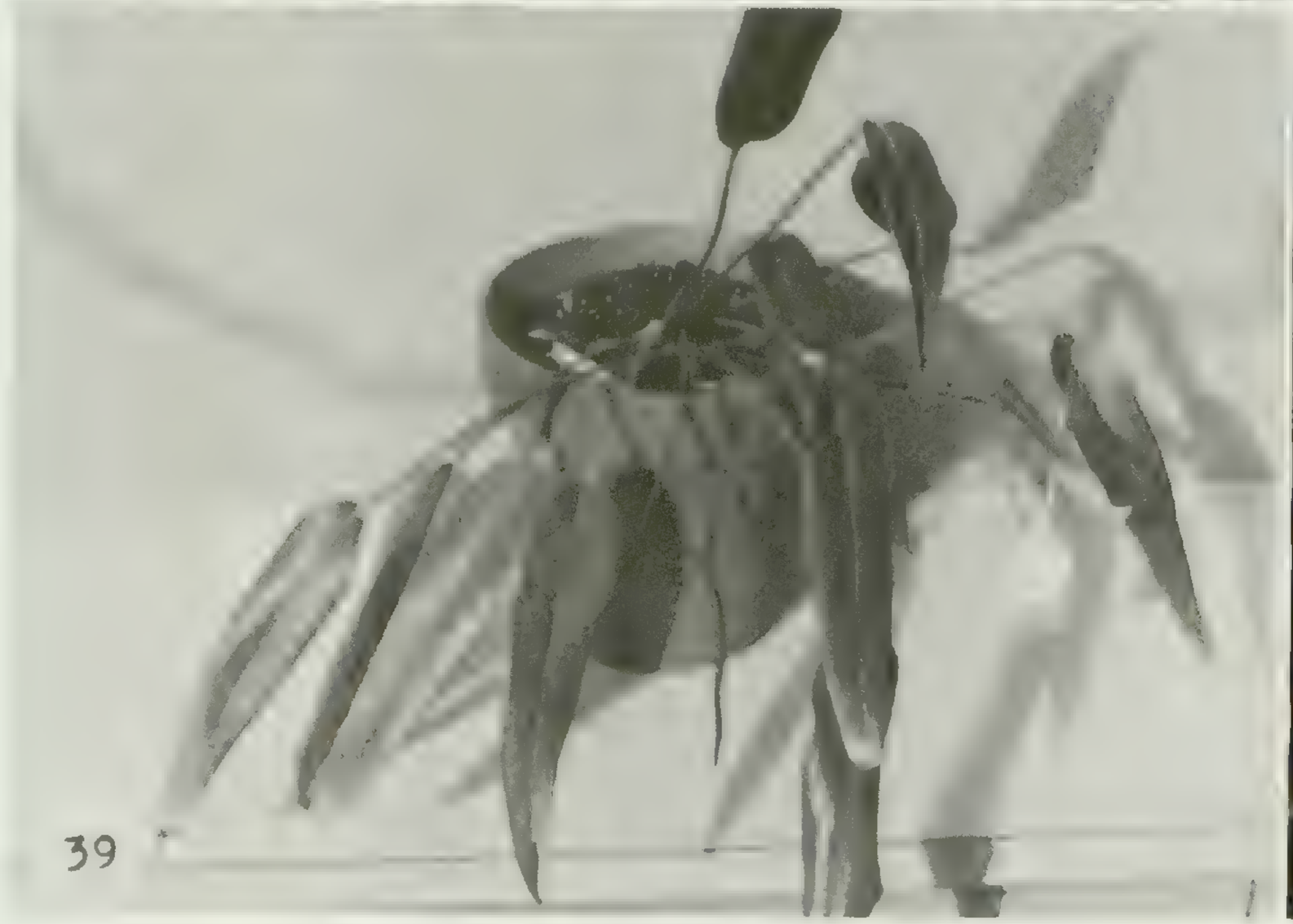
VERAGUAS: road between Escuela Agricola Alto Piedra & Calovébora, *Croat 27686* (MO, PMA), *27740* (MO).

Anthurium colonicum K. Krause, Bot. Jahrb. Syst. 54(Beibl. 118): 123. 1916. TYPE: Panama. Colón: forest around Portobelo, 5–200 m, *Maxon 5801* (US, holotype).

Epiphyte; stems short, ca. 7 cm diam.; internodes and leaf scars obscured by thick roots and cataphyll fibers; cataphylls coriaceous 20–25 cm long, acute and cuspidate at apex, with a hooked subapical apiculum, drying tan (B & K Yellow-red 9/10), persisting intact ultimately weathering to longitudinal fibers or deciduous. LEAVES spreading; petioles subterete, 26–90 cm long, narrowly and bluntly sulcate; geniculum 2–4.5 cm long; blades ovate-triangular, moderately thick, abruptly acuminate at apex, broadly to deeply lobed at base, 39–83 cm long, (9–)13–39 cm wide, broadest in the lower half of the blade; anterior lobe 38–76 cm long, the margins convex; posterior lobe (5.5–)8–17 cm from apex of sinus to outermost point; sinus arcuate, arcuate with petiole decurrent or hippocrepiform in larger blades, the apex rounded to weakly acute; both surfaces semiglossy; midrib flat at base, narrower midway, more acutely raised at apex above, diminishing and flat toward apex above, convexly raised below; basal veins 2–4 pairs, usually free to base sometimes coalesced 1–2.5 cm, the posterior rib naked, sharply turned up on outer margin; primary lateral veins 13–17 per side, departing the midrib at 50–65° angle, straight to weakly curving near collective vein, raised near midrib, sunken toward collective vein above, raised below; interprimary and secondary veins weakly sunken above, prominulous below; collective vein arising from the first basal vein or one of the lowermost primary lateral veins, 3–5 mm from the margin. INFLORESCENCE spreading to pendent; peduncle terete, 15–48 cm







FIGURES 37–40. 37. *Anthurium crassiradix* var. *crassiradix* Croat, *Kamemoto 249*. — 38. *Anthurium crassiradix* var. *crassiradix* Croat, *Croat 34315*. — 39, 40. *Anthurium crassiradix* var. *purpureospadix* Croat, *Croat 37399*.

FIGURES 41–44. 41, 42. *Anthurium colonense* Croat, *Croat 36959*. —43, 44. *Anthurium concolor* K. Krause, *Croat 33637*.

long, 0.6–1.3 cm diam., ca. half as long as petioles; spathe coriaceous, dark green, heavily tinged violet purple, lanceolate to broadly lanceolate, 10–18.5 cm long, 2.5–6 cm wide, broadest just above base, strongly reflexed and recurled, cuspidate-acuminate at apex, acute to obtuse at base, inserted at 60–65° angle on peduncle; spadix usually sessile, sometimes stipitate to 1 cm, green tinged violet purple, tapered toward apex, (5–)15.5–28 cm long, 1.2–3 cm diam. at base, 0.7–1.7 cm diam. at apex; flowers 4-lobed, 2.3–3 mm long, 2.8–3 mm wide, the sides sigmoid, 6–11 flowers visible in the principal spiral; tepals matte, punctate, lateral tepals 1.4–1.9 mm wide, the inner margin broadly rounded, erect; pistils pale green, emergent to 1 mm before anthesis, exserted to 3 mm at anthesis; stigmas linear, ca. 0.5 mm long, violet purple with droplets apparent ca. 1 week (during anthesis), drying black as stamens emerge; stamens emerging from the base, the laterals first quickly followed by alternates, exserted on transparent, fleshy, filaments 2–2.5 mm long; anthers 0.9–1.2 mm in both directions, scarcely retracted and held at sides of exserted pistil; thecae ovoid-ellipsoid, slightly divaricate; pollen white. INFRUCTESCENCE pendent; berries orange (B & K Yellow-red 8/7.5), narrowly ovoid-ellipsoid, acute at apex, ca. 10 mm long; seeds 2, pale yellow-green, brownish at apex and base, 4–4.8 mm long, 2.3–2.5 mm wide, enveloped in an amber sticky substance, briefly appendaged at base. Figs. 32 and 33.

Anthurium colonicum is endemic to Panama and ranges from Veraguas to Coclé, Panamá, and Colón Provinces from near sea level to 1,150 m in tropical wet and premontane rain forest life zones.

The species is a member of section *Pachyneurium* and is distinguished by its relatively elongate, generally subcordate leaf blades and its frequently stubby spadix with exserted stamens, but especially by its sharply pointed, early emergent pistils, its wavy margined spathe, and its elongate sharply pointed orange berries.

It is most closely related to *Anthurium nervatum,* which has similar veiny leaf blades, a similarly reflexed purplish spathe, and moderately acute orange berries. The latter differs in generally having the primary lateral veins more numerous (12–30 versus 7–12) and especially by its spathe that is straight to merely twisted but not markedly undulate marginally and by its spadix that has the pistils blunt, emerging with the anthers and tepals that are moderately flat at anthesis. *Anthurium colonicum* has pistils early emergent and has the tepals turned markedly upward at anthesis. In addition, the stamens of *A. colonicum* are white to yellowish when fresh whereas those of *A. nervatum* are orange at anthesis.

COCLÉ: Alto Calvario, *Folsom 2493* (MO); N of El Copé, *Folsom 5820* (MO); El Potroso, *Folsom & Collins 1541* (MO); La Mesa, *Hammel 3868* (MO).

COLÓN: vicinity Nuevo Tonosí, *Croat 33519* (B, MO, PMA, RSA, US); between Portobelo & Nombre de Dios, *Croat 49786* (MO); Río Guanche, *Croat 36943* (MO), *Davidse & D'Arcy 10077* (MO), *Hammel 4901* (MO), *Hammel et al. 4925* (MO); Río Indio, *Croat 33602* (B, F, M, MO, PMA, US), *33640* (MO).

PANAMÁ: El Llano-Cartí Road, *Croat 25096A* (B, F, K, MO, NY, PMA, S, SEL, US, VEN), *25174, 33760, 49114* (MO), *Mori 2285* (MO), *Nee et al. 8757* (MO), *Sytsma 1724* (MO); Campo Tres beyond Cerro Jefe, *Croat 27096* (MO).

VERAGUAS: vicinity Santa Fe, *Croat 27544* (F, MO), *25613* (MO).

Anthurium coloradense Croat, sp. nov. TYPE: Panama. Chiriquí: Cerro Colorado, near Continental Divide, 1,500 m, *Antonio 1466* (MO 1782436, holotype).

Planta terrestris; cataphyllum persistens, findins in fibris grossis pallidis; petiolus sulcatus; lamina ovata, modice membranacea, basi profunde cordata, usque 63 cm longa, et 46 cm lata; inflorescentia plus minusve erecta; pedunculus usque 34 cm longus; spatha membranacea, viridis, oblongo-lanceolata, usque 17 cm longa et 1.5 cm lata; spadix luteo-viridis, usque 17 cm longus; baccae ignotae.

Terrestrial; stems moderately short, 2.5–3 cm diam.; the internodes to ca. 3 cm long; cataphylls promptly weathering to coarse, pale fibers. LEAVES with petioles sulcate adaxially; blades ovate, moderately thin, abruptly acuminate at apex (the acumen narrowly inrolled), deeply lobed at base, to 63 cm long, ca. 46 cm wide, usually broadest in the lower third; anterior lobe to 47 cm long, broadly rounded along the margin, posterior lobes broadly rounded, directed toward the base; sinus spathulate, to 13 cm deep, closed or nearly so; both surfaces weakly glossy on drying, scarcely paler beneath; midrib sharply raised above (dry), raised below; basal veins to 8 pairs, the first to fourth pairs free to the base, the remainder coalesced ca. 2 cm; primary lateral veins to 15 per side, departing the midrib at 55–60° angle, gradually arcuate to the collective vein, drying sharply raised above, prominently raised and paler than the surface below; interprim-

ary veins irregular, drying prominulous above, prominent below but much less conspicuous than the primary lateral veins, interconnected to the primary lateral veins by prominent tertiary veins; collective vein arising from the third basal vein, mostly 1–3 mm from the margin, weakly sunken above, prominent beneath. INFLORESCENCE semierect; peduncle to 34 cm long, ca. 5 mm diam., terete; spathe thin, green, spreading, oblong-lanceolate, to 17 cm long, 1.5 cm wide, broadest near the base, acuminate at apex, acute at the base, decurrent ca. 1.5 cm, inserted at ca. 45° angle on peduncle; stipe ca. 4 mm long, 4 mm diam. (dried); spadix yellow-green, gradually tapered, to 17 cm long, to 7 mm diam. near the base, to 3 mm diam. near the apex, held weakly forward at ca. 25° angle from the peduncle; flowers rhombic, 3.5–3.8 mm long, 2.2–3.2 mm diam., 5–6 flowers visible in the principal; tepals drying tan, minutely and densely glandular-punctate with a few conspicuous raphide cells, weakly glossy, lateral tepals 2.3–2.5 mm wide, the inner margin broadly rounded, thin; pistils probably weakly exserted; stigma 0.7 mm long, 0.6 mm wide; emergence of stamens not observed. INFRUCTESCENCE not known. Fig. 45.

Anthurium coloradense is known only from the type collection made in Panama in Chiriquí Province on Cerro Colorado at 1,500 m in premontane rain or lower montane rain forest.

The species is best placed in section *Polyneurium* and is distinguished by its thin, ovate, relatively veiny blades that dry green, and have the collective vein arising from the third or fourth basal vein, but especially by its narrowly tapered, greenish yellow spadix with five to six flowers visible per spiral. Its leaves are remarkably similar to those of *Anthurium caperatum,* differing only in having glossier surfaces and in having inconspicuous tertiary veins. However, the inflorescence of *A. coloradense* differs markedly from *A. caperatum,* the latter being only slightly tapered to the apex with more than 12 flowers visible in the principal spirals.

Anthurium coloradense is also similar to *A. pauciflorum,* but that species is markedly smaller in every respect and its tepals lack the conspicuous raphide cells that are characteristic of *A. coloradense.*

CHIRIQUÍ: Cerro Colorado, *Antonio 1466* (MO).

Anthurium concinnatum Schott, Prod. Aroid. 522. 1860. *Anthurium bogotense* Schott var. *concinnatum* (Schott) Engl., Monogr. Phan. 2: 184. 1879. TYPE: Costa Rica. Cartago: Turrialba, *Oersted s.n.* (Photo of Schott Aroid Drawing #709; NYBG Neg. #N.S.3905).

Epiphytic or terrestrial; stems to 1 m or more long, 2.5–4 cm diam.; cataphylls drying brown, splitting at base, remaining intact at apex; petioles subterete, weakly and bluntly sulcate, 35–75 cm long, 0.6–1.2 cm diam.; blades subcoriaceous, narrowly ovate, 37–58 cm long, 21–34 cm wide, deeply lobed at base. Inflorescence spreading-pendent, peduncle 35–65 cm long, spathe oblong-lanceolate, pale green turning purplish, 8.5–27 cm long, 1.5–5 cm wide; stipe to 2.5 cm long, sometimes arching; spadix green turning purplish, 5–26 cm long, sometimes arched at base, 8–16 mm diam. at base; berries orange; seeds 1–2. See Croat (1983: 279) for a more complete description.

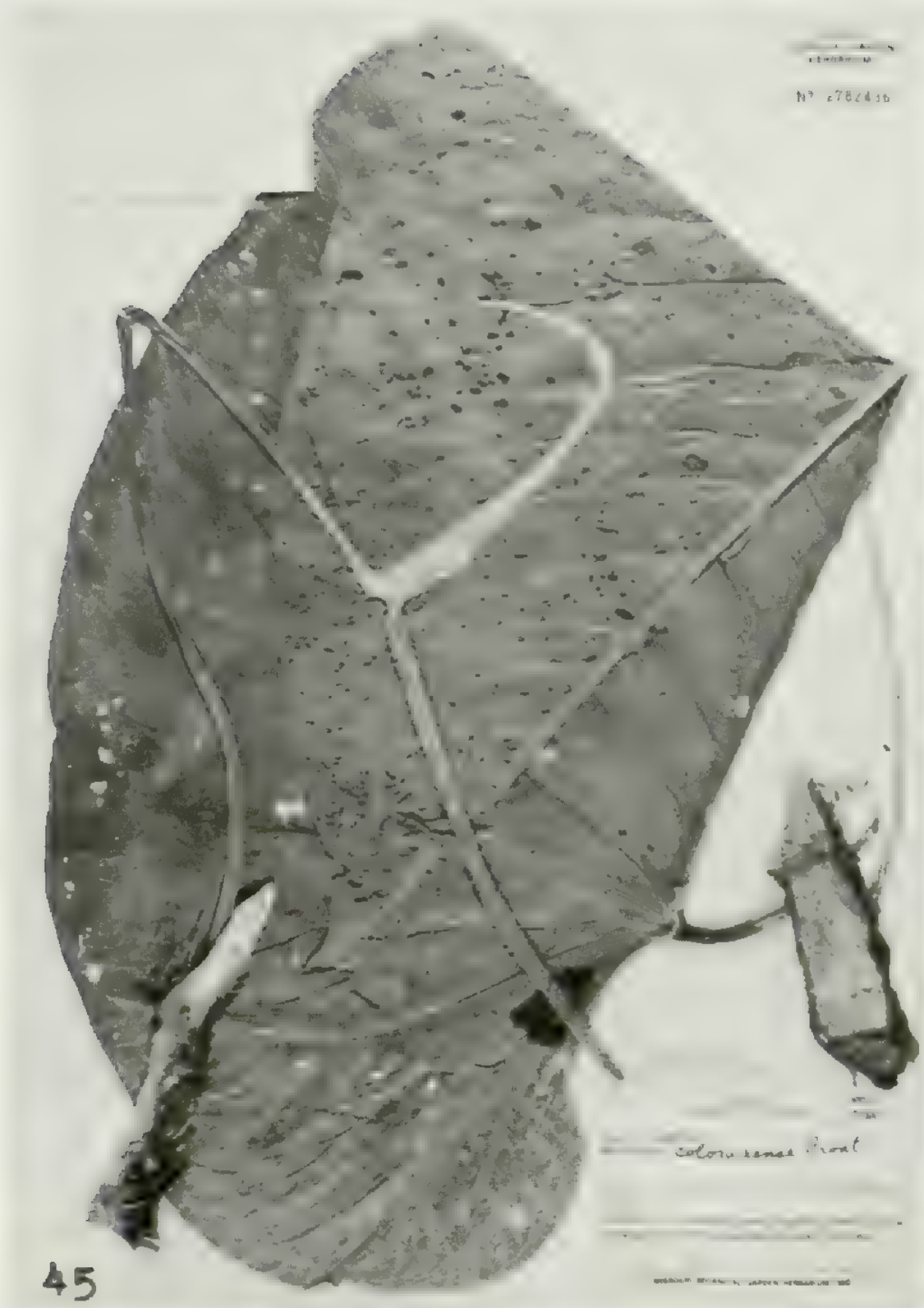
The species ranges from Costa Rica to Panama at elevations of 2,000 to 3,000 m in lower montane rain forest, growing at higher elevations than any other *Anthurium* in Costa Rica or Panama.

Anthurium concinnatum is in section *Belolonchium* and is recognized by its large, subcoriaceous, cordate blade, its curved stipe, its persistent, exserted stamens, and its high altitudinal range. The species usually has long stems that, although rooted in the soil, usually lean on trees for support.

CHIRIQUÍ: E slopes of Cerro Pando, *Knapp 1654* (K, MO); Cerro Pata de Macho, NE of Boquete, *Croat 48519* (MO); vicinity Cerro Punta, *Allen 1453* (MO), *Almeda & Nakai 3543* (MO), *Croat 13761* (MO, SCZ), *16169* (F, MO), *26326, 48570* (MO), *Croat et al. 16088* (MO), *Folsom 6043* (MO), *Hammel 1419* (MO), *Mori & Kallunki 5647* (MO), *Stevens 18166* (MO), *Sytsma & Stevens 2096, 2184* (MO), *Webster & Breckon 16589* (DAV); Cerro Respinga, *D'Arcy 9990, 10824* (MO); Las Nubes, *Croat 26493* (MO, PMA), *Liesner 326A* (MO), *Luteyn & Wilbur 4649* (DUKE); vicinity Volcán Baru, *Croat 34992* (MO, RSA), *Davidse & D'Arcy 10263* (MO), *Hammel 2868* (MO), *Tyson 6350* (MO), *Tyson & Loftin 6111* (SCZ), *Woodson & Schery 382* (MO); Upper Río Chiriquí Viejo, *Wilbur et al. 15365* (DUKE); Cerro Horqueta, *Luteyn 3779* (DUKE); trail from Bajo Grande, *Wilbur et al. 15177* (DUKE).

COCLÉ: NE of El Valle de Antón, *Luteyn 1242* (DUKE).

PANAMÁ: Cerro Campana, *Luteyn & Kennedy 1835* (DUKE).



FIGURES 45–48. 45. *Anthurium coloradense* Croat, *Antonio 1466*.—46. *Anthurium correae* Croat, *Kennedy & Dressler 2936*.—47, 48. *Anthurium crassilaminum* Croat, *Hammel 7232*.

Anthurium concolor K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 11: 606. 1932. TYPE: Panama. Colón: Río Indio de Gatún, less than 300 m, *Pittier 2798* (US, holotype).

Rosulate epiphyte; stems ca. 20 cm long, ca. 2.5 cm diam.; roots pale greenish white, in a thick mass; cataphylls coriaceous, 11–14 cm long, drying reddish brown (B & K Yellow-red 3/10), persisting more or less intact, ultimately deciduous. LEAVES erect; petioles 2–16 cm long, more or less quadrangular, broadly sulcate, 3-ribbed abaxially; geniculum 1–2 cm long; blades oblanceolate to narrowly obovate, coriaceous, acuminate or acute at apex, acute to narrowly rounded or weakly lobed at base, 30–108 cm long, 13–36 cm wide, broadest above the middle; both surfaces semiglossy; midrib flat at base above, becoming acutely raised toward middle, sunken at apex, 3-ribbed at base below, becoming acutely raised toward apex; primary lateral veins 10–17 per side, departing midrib at 50–65° angle, raised on both surfaces; collective vein arising from one of the primary lateral veins in apical one-fourth of blade, 5–10 mm from margin. INFLORESCENCE arching-erect to spreading; peduncle 30–75 cm long, 5–9 mm diam., usually subterete, sometimes singularly ribbed; spathe moderately thick, green tinged with violet purple, narrowly oblong-ovate or oblong-elliptic, 5.5–9.5 cm long, 2.1–3.5 cm wide, gradually to abruptly acuminate at apex, acute to obtuse at base, inserted at 10–70° angle; spadix dark purple-violet, becoming brown, 5.7–16 cm long, 8–12 mm diam. near base, 7–9 mm diam. near apex; flowers rhombic, 2–3.3 mm long, 2.4–3.5 mm wide, the sides more or less straight parallel to spirals, sigmoid perpendicular to spiral; 7–9 flowers visible in the principal spiral, 6–10 flowers visible in the alternate spiral; tepals matte to semiglossy; weakly to conspicuously, densely punctate, forming large nectar droplets on surface at anthesis; lateral tepals 2–2.3 mm wide, the inner margins straight; pistils weakly emergent, green tinged violet purple to violet purple; stigmas broadly elliptic, brush-like, weakly exserted, with droplets 5–8 days before stamens emerge; stamens emerging rapidly in a scattered manner throughout, sometimes those at apex emerging first; anthers purplish brown to purple-violet, 0.8–1 mm long, 0.8–1.1 mm wide, held above tepals in tight cluster obscuring pistil; thecae oblong-elliptic, more or less divaricate; pollen purplish (B & K Purple 6/10). INFRUCTESCENCE pendent, the spadix to 30 cm long, 2.5 cm diam.; berries obovoid, red, 7–8 mm long; mesocarp transparent, gelatinous; seeds 2, oblong-elliptic, white, ca. 4 mm long. Figs. 43 and 44.

The species is known from central Panama on the Atlantic slope ranging to northern Colombia from sea level to 100 m in tropical wet forest and wetter parts of tropical moist forest. It is expected in Costa Rica in Limón Province.

The species is in section *Pachyneurium*. Although its leaves are typical for that section, it differs from other members of the section by its short, cylindrical, violet purple spadix that is held erect at anthesis and by its tendency to form globular droplets on its tepals. Also characteristic of this species are its purplish pollen, its bright red berries, and its petioles that are broadly sulcate adaxially and usually prominently three-ribbed abaxially.

Anthurium concolor is not closely related to any other species but has been confused with *A. salviniae* because of its similar leaves, habit, and infructescence. Due to similar leaf shape and petiole shape, the species could also be confused with *A. upalaense* Croat & Baker, but that species has a long-tapered inflorescence at anthesis.

BOCAS DEL TORO: no other location, *Carleton 377* (US).

CANAL ZONE: Barro Colorado Island, *Croat 8154* (MO); S of Colón on Río Providencia, *Tyson & Blum 3999* (SCZ), *3936* (MO); vicinity Fort Randolph, *Standley 28723* (US); Fort Sherman, *Standley 31018* (US); Matachin to Las Cascadas, *Cowell 324* (NY).

COLÓN: vicinity Río Indio, *Croat 33637* (F, MO, PMA, US).

Anthurium consobrinum Schott, Oesterr. Bot. Wochenbl. 5: 66. 1855. TYPE: Nicaragua. Dept. Río San Juan, San Juan River, *Friedrichsthal s.n.* (Photo of Schott Aroid Drawing #353; NYBG Neg. #N.S.3874).

Rosulate epiphyte; stems short, 1.5–2 cm diam.; cataphylls drying rusty brown, persisting intact, ultimately deciduous; petioles broadly sulcate, rounded abaxially, 2.5–9 cm long, 0.6–1 cm diam.; blades oblanceolate, subcoriaceous, 19–64 cm long, 3.5–20 cm wide, acute to narrowly rounded at base. Inflorescence erect to arching; peduncle 20–43 cm long, 5–6 mm diam., terete; spathe linear-lanceolate, subcoriaceous, green, 4.5–7.5 cm long, 0.8–2.5 cm wide; spadix greenish white, turning pinkish tan, strongly

curved, 6–9 cm long, 1–1.5 cm diam.; berries translucent, greenish white with apex reddish to purplish, narrowly acute; seeds 2. See Croat (1983: 281) for a more complete description.

The species ranges from Nicaragua to Panama from sea level to 800 m. It is a common species from tropical wet forest and premontane wet basal belt transition life zones on the Caribbean slope.

The species is in section *Pachyneurium* and is distinguished by its rosulate habit, its oblanceolate blades, its short sulcate petioles, its massive whitish root system, its spreading inflorescence with upturned nontapered spadix, its markedly protruding styles, and by its berries that are greenish white at the base and reddish at the apex.

Anthurium consobrinum is probably most closely related to *A. fatoense* of Costa Rica and Panama and differs from that species by its abaxially rounded petioles, its nearly oblong spadix, and by its berry coloration. *Anthurium fatoense* has a quadrangular petiole, a cylindroid-tapered spadix and pale yellow or orange berries.

VERAGUAS: vicinity Escuela Agricola Alto Piedra near Santa Fe, *Knapp & Kress 4357* (MO), *Knapp & Dressler 5435* (MO).

Anthurium correae Croat, sp. nov. TYPE: Panama. Panamá: 11–12 km above Pan-American Hwy. on road from El Llano to Cartí-Tupile, 200–350 m, *Kennedy & Dressler 2936* (MO 2162459, holotype; F, K, NY, PMA, US, isotypes).

Planta epiphytica; cataphyllum deciduum; petiolus sulcatus, 1–3.5 cm longus; lamina oblanceolate, basi attenuata, 7–17 cm longa, 2–3.7 cm lata; inflorescentia erecta; pedunculus dilute 1-costatus; spatha pallide viridis, lanceolata, 2.5–3.5 cm longa, 7–9 mm lata, decurrens usque ca. 1 cm; spadix viridis, 2–3 cm longus; baccae atropurpureae, basi pallidiores, obovoido-ellipsoidae, 9–10 mm longae.

Epiphyte; stems 1–5 cm long, less than 1 cm diam.; roots dense, often drying flattened; cataphylls ca. 2 cm long, drying brown, weathering into fibers, ultimately deciduous. LEAVES erect-spreading; petioles 1–3.5 cm long, 2–3 mm diam., sulcate; geniculum 1–2 cm long, scarcely thicker than petioles; blades oblanceolate, acuminate to abruptly acuminate at apex, attenuate at base, 7–17 cm long, 2–3.7 cm wide, broadest above middle; both surfaces semiglossy, the lower surface only slightly paler; midrib raised above and below (dry); primary lateral veins 6–8 per side, departing midrib at ca. 45° angle, scarcely raised above and below (dry); straight to collective vein; interprimary veins usually obscure, sometimes more or less as prominent as primary lateral veins; collective vein arising from the lowermost primary lateral vein, 2–5 mm from margin, drying obscure above, prominulous below, weakly to prominently loop-connecting primary lateral veins. INFLORESCENCE erect; peduncle 2.5–6.5 cm long, 2–3 mm diam., weakly 1-ribbed, much longer than petioles; spathe pale green, lanceolate, 2.5–3.5 cm long, 7–9 mm wide, broadest near base, acute at apex and base, decurrent to ca. 1 cm, inserted at 70° angle on peduncle; stipe 3–6 cm long; spadix green, 2–3 cm long, 3–4 mm diam. near base, 2–3 mm diam. at apex; flowers rhombic, 2.5–3.2 mm long, 1.5–2 mm wide, the sides straight to slightly sigmoid, 2–4 flowers visible in either spiral; lateral tepals ca. 2 mm wide, the inner margin more or less straight; pistils weakly raised; stamens emerging from the base, held at edge of tepals; anthers held inward over pistil, ca. 0.3 mm long, 0.5 mm wide; thecae ovoid, slightly divaricate. INFRUCTESCENCE pendent; spathe persistent; spadix to 4 cm long, 2–2.5 cm diam. (with berries exserted); berries obovoid-ellipsoid, rounded at apex, green becoming black-purple, somewhat paler toward base, 9–10 mm long, 6–7 mm diam.; pericarp moderately thick; seeds 1 or 2, tan, discoid to ellipsoid, 6–7.5 mm long, 4.5–5 mm wide, 1.2 mm thick. Fig. 46.

Anthurium correae is endemic to Central Panama on both sides of the canal in tropical wet forest at 300 to 450 m.

The species is distinguished by its generally small, oblanceolate, acuminate blades that usually dry blackened, its prominently decurrent, lanceolate, green spathe, its cylindroid, slightly tapered, green spadix, and its dark purple berries. Its sectional placement is uncertain, and it is provisionally placed in section *Urospadix*.

The species is most similar to small specimens of *Anthurium michelii* that have similar green, lanceolate spathes, long-stipitate, greenish spadices, and purple berries. The latter species has larger leaves with typically conspicuous tertiary veins on drying. Collections of *A. michelii* west of the isthmus have blades usually broadest at the middle whereas collections east of the isthmus more frequently have blades broadest above the middle like those of *A. correae*. However, *A. correae* is also similar to *A. llanense* which also

has purple berries and leaves of similar shape, but that species has blades that dry green, a typically ovate spathe, and a dark green, subglobular spadix.

Anthurium correae is named in honor of Lic. Mireya Correa A., curator of the herbarium at the University of Panama, who, with Bob Dressler, made the first collection of the species in 1968.

COCLÉ: N of Continental Divide above El Copé and El Potroso, *Sytsma 2538* (MO).

COLÓN: S approach to Cerro Bruja, *Hammel 3191* (MO); ridge between Río Piedras & Río Gatún waterbeds, SW of Cerro Bruja, *Sytsma et al. 4298, 4307* (MO); vicinity Santa Rita Ridge, *Correa & Dressler 638* (MO), *Croat 13934* (MO), *Sytsma 1093, 1375* (MO).

PANAMÁ: El Llano-Cartí Road, *Folsom & Collins 1521* (MO), *Kennedy & Dressler 2936* (F, K, MO, NY, PMA, US), *Mori & Kallunki 2262, 2904* (MO), *Sytsma 995* (MO).

SAN BLAS: Cerro Habú, *Sytsma et al. 2764* (MO).

Anthurium cotobrusii Croat & Baker, Brenesia 16(Supl. 1): 43. 1979. TYPE: Panama. Chiriquí: above San Félix, along mining road, 18–27 mi. off Pan-American Hwy. (above Chame on turnoff to Escopeta), 1,200–1,500 m, *Croat 33058* (MO 2381191, holotype; B, CAS, COL, CR, DUKE, F, GH, K, M, NY, PMA, RSA, SEL, US, W, isotypes; Live at MO).

Terrestrial or sometimes epipetric or epiphytic; stem 1–3 cm diam., usually less than 15 cm long; cataphylls turning tan, ultimately weathering to fine persisting fibers; petioles 15–65 cm long, 5–7 mm diam., more or less terete, weakly sulcate or flattened; blades narrowly ovate to triangular, subcoriaceous, shallowly and broadly lobed at base, 16–56 cm long, 9.5–25 cm wide. Inflorescence erect-spreading; peduncles terete, (4.5–)20–46 cm long; spathe green, pale green or green with purplish veins or heavily suffused with purple on inner surface, sometimes tinged purple only at base medially, ovate to narrowly ovate, (2.5–)5–9(–12) cm long, (1.7–)2.7–4.5 cm wide; stipe green or green tinged with purple, 1–2 cm long; spadix green to dark purple-violet at anthesis, (2.5–)5–25 cm long, 7–15 mm diam. at base, with a pungent, sweet scent when droplets are fresh; berries pale orange, obovoid, 12–15 mm long, 8–11 mm diam., rounded at apex, the apex darker, depressed with 4 short, slightly elevated ridges; seeds usually 2. See Croat (1983: 282) for a more complete description.

Anthurium cotobrusii is found in Costa Rica and Panama in premontane wet forest at elevations of 1,000 to 1,500 m.

The species is in section *Belolonchium* and is most easily distinguished by its subcoriaceous leaves that have more or less obscure reticulate veins when fresh but have conspicuous reticulate veins when dry and by its prominently tapered, violet purple spadix with a tight cluster of stamens. The early emergent berries are quadrangular with prominent ridges radiating from the center to the corners.

It is most easily confused with *Anthurium ranchoanum,* which has similar leaves; the latter, however, has a short, cylindroid, scarcely tapered spadix that is usually nodding and hooded by the spadix when in flower and berries that are smoothly rounded at the apex.

CHIRIQUÍ: vicinity Planes de Hornito, *Croat 48850* (MO); above San Félix, *Croat 33058* (B, CAS, COL, CR, DUKE, F, GH, K, M, MO, NY, PMA, RSA, SEL, US, W), *33147A, 33152* (MO), *Nee 10699* (MO).

Anthurium crassilaminum Croat, sp. nov. TYPE: Panama. Coclé: along road to Coclecito, near Continental Divide, *Hammel 7232* (MO 2817155, holotype; B, C, K, PMA, US, isotypes; Live at MO).

Planta epiphytica aut epipetra; cataphyllum subcoriaceum persistens in reticulum fibrarum; petiolus sulcatus, 3–17 cm longus; lamina coriacea, oblongo-oblanceolata ad raro anguste elliptica, costa conspicue arcuata, 25–38 cm longa; 10–12.5 cm lata, pagina inferiore dense glanduloso-punctata; inflorescentia erecta; pedunculus teres, 10–42 cm longus; spatha subcoriacea, viridis, lanceolata ad oblonga, 3.5–5 cm longa, 1–3 cm lata; spadix viridis lavandulascens, 5–6.5 longus; baccae ignotae.

Epiphytic or epipetric herb; stems less than 15 cm long, 1.5–2.5 cm diam.; roots moderately dense, spreading or descending, 2–3 mm diam.; cataphylls moderately thick, ca. 4 cm long, narrowly acuminate at apex (with short subapical apiculum), drying reddish brown, weathering into reticulate fibers. LEAVES erect; petioles 3–17 cm long, shallowly and bluntly sulcate, rounded abaxially; geniculum 1–2 cm long; blades coriaceous, oblong-oblanceolate to rarely narrowly elliptic, markedly arched along midrib, short-acuminate at apex, acute to attenuate at base, 25–38 cm long, 10–12.5 cm wide, broadest just above middle or rarely at middle; upper surface semiglossy, eglandular, lower surface matte, densely glandular-punctate; midrib broadly raised

at base, narrowing at middle, diminishing and sunken at apex above, broadly raised below, flat at apex; primary lateral veins 6–10 per side, departing midrib at 40–60° angle, clearly visible on new leaves, less conspicuous on older blades, merely etched to weakly sunken above, flat to prominulous below, straight to collective vein; interprimary veins scarcely visible above and below; collective vein arising from the base, 7–10(–13) mm from margin, etched to weakly sunken above, prominulous below. INFLORESCENCE erect, equalling or longer than leaves; peduncle 10–42 cm long, 5–7 mm diam., terete, tinged red-violet near base, usually 2–3 times longer than petioles; spathe subcoriaceous, green, lanceolate to oblong, 3.5–5 cm long, 1–3 cm wide, broadest below middle, obtuse to rounded and cuspidate at apex, acute at base, decurrent ca. 2.5 cm; spadix green, becoming pale lavender (B & K Blue-purple 7/7.5), faintly scented of orange peels from midmorning to midafternoon before stamens emerge, 5–6.5 cm long, 7–10 mm diam. at base, 3–4 mm diam. at apex; flowers 4-lobed, 2.3–2.9 mm long, 2.9–3.5 mm wide, the sides sigmoid, 4–5 flowers visible in the principal spiral, 9–10 flowers visible in the alternate spiral; tepals matte, minutely papillate, lateral tepals 1.3–1.7 mm wide, the inner margin convex, the outer margin conspicuously 3–4-sided; pistils emergent, not raised, pale green, becoming pinkish; stigma ellipsoid, 0.2 mm long, dark purple; lateral stamens emerging from the base, retracting before alternates emerge; anthers reddish, ca. 0.5 mm long, ca. 0.7 mm wide; thecae ovoid-ellipsoid, slightly divaricate; pollen lavender. INFRUCTESCENCE not known. Figs. 47 and 48.

Anthurium crassilaminum is endemic to Panama and is known only from the type collection in Coclé Province at ca. 850 m in premontane rain forest.

The species is in section *Porphyrochitonium* and is distinguished by its coriaceous, oblong-lanceolate, markedly curved blades and the tapered lavender spadix. It is most closely related to *Anthurium curvilaminum,* which has similar coriaceous, curved blades. The latter differs, however, in that it has a more cylindroid, scarcely tapered spadix that is darker violet purple, has eight to 13 flowers visible in the principal spiral (versus 4–5 in *A. curvilaminum*), and has narrowly acuminate cataphylls (versus narrowly rounded with a subapical apiculum in *A. curvilaminum*). In addition, *A. crassilaminum* differs in having stamens that retract beneath the tepals and flowers that have a related but distinctly different aroma. The stamens of *A. curvilaminum* persist above the tepals after anthesis.

COCLÉ: along road to Coclecito, near Continental Divide, *Hammel 7232* (B, C, K, MO, PMA, US).

Anthurium crassiradix Croat, sp. nov.

a. Anthurium crassiradix var. **crassiradix.** TYPE: Panama. Colón: Santa Rita Ridge Road, along trail at end of road that goes to Río Indio, beginning 10.6 km from the Transisthmian Hwy., 150–200 m, *Croat 34315* (MO 2817050, holotype; B, BR, COL, F, PMA, US, VEN, isotypes; Live at MO).

Planta epiphytica; cataphyllum subcoriaceum, basi findens in fibres tenuibus, apice persistens intactum, petiolus plus minusve triangulatus, argute sulcatus, 6–26 cm longus; lamina subcoriacea, anguste ovato-oblonga, basi truncata ad leniter subcordata, 13–25 cm longa, 4–8.5 cm lata, pagina inferiore leniter glanduloso-punctata; inflorescentia effusa et arcuata; pedunculus triangulatus, conspicue alatus, 18–50 cm longus; spatha viridis, linearis-lanceolata, 5–9.5 cm longa, 4–10 mm lata; spadix viridis, interdum pallide luteus ad viridis, luteus subanthesi; 10–17 cm longus; baccae lavandulae late obovoidae, 5–7 mm longae.

Epiphyte, usually resting on smaller branches with little or no accumulation of debris; stem usually less than 10 cm long, 1–3 cm diam.; internodes very short; roots pale green, 4–10 mm diam., often forming a tight knotty coralloid mass; cataphylls moderately thick, green, 5–6 cm long, drying brown (B & K Yellow 3/2.5), weathering to fine fibers at base, remaining intact at apex. LEAVES erect-spreading; petioles 6–26 cm long, 3–6 mm diam., more or less triangular, sharply sulcate; geniculum 0.8–2 cm long; blades moderately thick, narrowly ovate-oblong, gradually acuminate to long-acuminate at apex, sometimes conspicuously curved to the side (the acumen sometimes flat), round, truncate or weakly subcordate at base, 13–25 cm long, 4–8.5 cm wide, broadest between base and middle; upper surface semiglossy to weakly glossy, eglandular; lower surface matte, weakly glandular-punctate; midrib convexly raised at base, narrowing toward apex, diminished and sunken near apex above, acutely raised at base below, becoming convex at middle, slightly raised at apex; basal veins 1–2(–3) pair, the lowermost obscure, joining the margin near the base, the second joining the margin in the lower one-fourth of the blade or continuing to apex, forming collective vein 2–9 mm

from margin, sunken above, raised below; primary lateral veins 7–12 per side, departing midrib at 35–75° angle, more or less straight to collective vein, weakly sunken above, raised below, lesser veins obscure above, scarcely visible below (tertiary veins clearly visible and weakly raised on drying). INFLORESCENCE spreading-arching, usually equalling or exceeding leaves; peduncle terete or subterete in early stages, becoming triangular and conspicuously winged, 18–50 cm long, 2.5–7 mm wide; spathe green, linear-lanceolate, 5–9.5 cm long, 4–10 mm wide, gradually acuminate at apex, obtuse at base, often withered and deciduous at anthesis, spadix green, sometimes pale yellow to greenish yellow at anthesis, 10–17 cm long, 4–6 mm diam. near base, 2–3 mm diam. at apex; flowers rhombic, 2.6–5.3 mm long, 2.2–3 mm wide, the sides straight to weakly sigmoid, 5–6 flowers visible in the principal spiral, 8–10 flowers visible in the alternate spiral; tepals semiglossy, inconspicuously punctate, the lateral tepals 2.5–2.7 mm wide, the inner margins straight or weakly convex; pistils weakly emergent, green, more or less square; stigmas oblong-linear, 0.7–0.8 mm long, brush-like and exserted with droplets several weeks before stamens emerge, drying 2–3 days before first anthers emerge; stamens emerging rapidly, beginning from the base, the laterals emerging first, the leading stamens preceding third and fourth by 4–5 spirals; anthers creamy white, to 0.7 mm wide, 0.3 mm long, held equidistant at sides of pistil, not contiguous, ultimately retracting completely, beginning from the base; thecae divaricate; pollen white. INFRUCTESCENCE pendent; berries lavender (B & K Blue-purple 6/10), broadly obovoid, broadly rounded or truncate at apex with a more or less circular, scarcely paler depression, 5–7 mm long, 4–8 mm diam., often slightly broader in the direction of the axis; pericarp thin, lacking raphide cells; mesocarp homogenous, fleshy, soft, lacking raphide cells, sweet; seeds (1–)2–3(–4), creamy white, 2.7–3 mm long, 1.8–1.9 mm wide, ovoid to oblong-ellipsoid, rounded at base, oblique at apex with elongate, sticky, translucent appendages at both ends. Figs. 37 and 38.

Anthurium crassiradix var. *crassiradix* is endemic to Panama at 150 to 1,000 m in tropical wet and premontane rain forest life zones. The collections are principally from Panamá and Colón Provinces east of the Canal Zone in the vicinity of Cerro Jefe, the El Llano-Cartí Road and the Santa Rita Ridge Road but also have been made along the Continental Divide in Coclé Province.

The species is a member of section *Porphyrochitonium* and is distinguished by its thick roots (hence the name *crassiradix*) usually forming a coralloid mass with all the roots contiguous or nearly so, as well as by its generally V-shaped petioles and thick, glandular-punctate (lower surface only) blades that are generally broadest below the middle with a well-developed second collective vein. Older plants are broadly rounded basally or even weakly subcordate. Other distinguishing features include the three-sided, winged peduncle, the long, slender, greenish spadix, and the lavender berries.

The species consists of two varieties. Variety *purpureospadix* differs from the typical variety in having purplish spadices and in having leaf blades semiglossy on the lower surface, whereas the typical variety has green spadices and leaf blades that are matte on the lower surface.

Anthurium crassiradix is most closely related to *A. cartiense,* but that species differs in having a shorter spadix and leaves that are narrowest below the middle and which also lack the secondary collective vein. In addition, *A. cartiense* apparently lacks the coralloid roots characteristic of *A. crassiradix.*

Anthurium crassiradix is more distantly related to *A. sagawae,* which also has a long-pedunculate inflorescence, a long tapered greenish spadix, and lavender berries. The latter differs, however, in having much larger, elliptic blades and a four- or five-ridged peduncle.

COCLÉ: near sawmill N of turnoff to Coclecito, *Hammel 1875, 1882* (MO).

COLÓN: SW of Cerro Bruja, *Sytsma et al. 4300, 4303, 4304* (MO); vicinity Santa Rita Ridge Road, *Antonio 3745* (MO), *Correa & Dressler 590* (DUKE, MO, PMA, SCZ), *Croat 34315* (B, BR, COL, F, MO, NY, PMA, US, VEN), *Hammel & D'Arcy 6365* (MO), *Sytsma 2038, 2063* (MO).

PANAMÁ: on road past Cerro Azul, *Mori & Kallunki 2174* (MO); vicinity Cerro Jefe, *Correa & Dressler 165* (PMA), *Croat 45031* (MO), *Gentry 4876* (MO, PMA), *Hammel 3696, 4876* (MO), *Sheffer 154, 189, 247* (MO), *Webster et al. 16461* (UC).

b. Anthurium crassiradix var. **purpureospadix** Croat, var. nov. TYPE: Panama. Coclé: La Mesa above El Valle de Antón, ca. 2 km W of Cerro Pilón, *Croat 37399* (MO 2395372, holotype; K, PMA, US, isotypes; Live at MO).

Planta epiphytica; cataphyllum persistens in fibris tenibus; petiolus subteres, anguste et obtusque sulcatus; lamina modice coriacea, lanceolata, basi acuta aut plus minusve rotundata, 10–27 cm longa, 1.7–5 cm lata, pagina inferiore dense glanduloso-punctata; inflorescentia effusa; pedunculus triangulatus, 8–20 cm longus, conspicue alatus; spatha modice membranacea, viridis interdum suffusa purpurea, oblongo-lanceolata, 2–4.5 cm longa, 5–7 mm lata; spadix viridis purpurescens, 5–11 cm longus; baccae ignotae.

Epiphyte; stem 4–6 cm long, 1–2 cm diam.; leaf scars ca. 8 mm wide; roots pale green, moderately short, 6–7 mm diam., descending; cataphylls 2.5–4 cm long, apiculate at apex, drying brown, splitting and sometimes weathering into fibers at base and persisting at base of leaves. LEAVES spreading; petioles 6–22 cm long, 2–5 mm diam., subterete, narrowly and bluntly sulcate; geniculum 1–1.5 cm long; blades moderately thick, lanceolate, gradually acuminate at apex, acute to obtuse or slightly rounded at base, 10–27 cm long, 1.7–5 cm wide; both surfaces semiglossy, the upper surface eglandular, the lower surface paler, densely glandular-punctate; midrib acutely raised above, somewhat higher than broad, diminished and sunken near apex, convexly raised below; primary lateral veins 4–7(–9) per side, departing midrib at ca. 35° angle, etched into surface above, prominulous below, straight to collective vein; interprimary veins scarcely visible above and below; collective vein arising from the base, etched into surface above, 2–7 mm from margin. INFLORESCENCE spreading, shorter than or equalling leaves; peduncle 8–20 cm long, 1.5–4 mm wide, triangular with conspicuously winged margins, tinged violet purple; spathe moderately thin, green (B & K Yellow-green 8/10), sometimes tinged violet purple, oblong-lanceolate, 2–4.5 cm long, 5–7 mm wide, broadest below middle, acute to acuminate at apex, rounded to obtuse at base, inserted at 60–70° angle; stipe thick, green; spadix green becoming purple, 5–11 cm long, 3.5–5 mm diam. near base, 1.5–2.5 mm diam. near apex; flowers rhombic, 3.4–4.8 mm long, 3–3.8 mm wide, the sides weakly sigmoid, 2–3 flowers visible in the principal spiral, 5–6 flowers visible in the alternate spiral; tepals semiglossy, smooth, the lateral tepals 2–3 mm wide, the inner margins more or less straight; pistils green, tinged violet purple, weakly exserted; stigmas elliptic, ca. 0.6 mm long, 0.4 mm wide, exserted, brush-like with droplets for ca. 2 weeks before first stamens emerge, drying grayish; stamens emerging in a slow progression from the base, the lateral pair briefly preceding the alternate pair; anthers cream, 0.2–0.5 mm long, 0.6–0.9 mm wide, held in a wide circle around pistil, sometimes contiguous; thecae ovoid-ellipsoid, slightly divaricate; pollen white. INFRUCTESCENCE not seen. Figs. 39 and 40.

Anthurium crassiradix var. *purpureospadix* is endemic to Panama in Coclé Province at 550 to 900 m in tropical wet or premontane rain forest.

The taxon is distinguished by its narrowly lanceolate, long-petiolate, subcoriaceous, glandular-punctate, long-acuminate leaf blades with shallowly etched veins above and by its subterete, narrowly sulcate petioles, but especially by its long-tapered, sharply pointed spadix that turns dark greenish purple and has exserted pistils at anthesis.

It differs from the typical variety of *A. crassiradix* in that it has a purplish spadix and blades that are glossier on the lower surface. Since the variety *purpureospadix* does occur almost within the known range of the typical variety, it may prove to be inseparable; as yet, however, no variation is evident in the typical variety in the coloration of the spadix and no tendency to turn purple is evident.

COCLÉ: La Mesa, above El Valle de Antón, *Croat 37399* (K, MO, PMA, US); between Continental Divide & El Potroso sawmill, *Sytsma et al. 2376* (MO).

Anthurium crassitepalum Croat, sp. nov. TYPE: Panama. Darién: Serranía de Pirre, along headwaters of Río Escucho Ruido, ca. 16 km due N of Alturas de Nique, lower montane rain forest, 1,530–1,550 m, *Croat 37948* (MO 2416720, holotype; PMA, isotype; Live at MO).

Planta epiphytica; cataphyllum modice membranaceum, basi findens, apice persistens plus minusve intactum; petiolus sulcatus, (5–)8–20(–28) cm longus; lamina subcoriacea, oblongo-elliptica ad anguste elliptica, basi acuta aut attenuata, 6.5–27 cm longa, 3–7 cm lata, pagina superiore obscure glanduloso-punctata, pagina inferiore dense glanduloso-punctata; inflorescentia effusa; pedunculus 13–29 cm longus, teres aut obscure 3–4 costatus; spatha modice membranacea, pallide viridis, interdum suffusa rubens, lanceolata ad ovata, 1.8–3.2 cm longa, 0.5–1.2 cm lata; spadix pallide viridis, 3–6.5 cm long; tepala margines externes conspicue elevata; baccae pallide lavandulae ad albidae, depresso-globosae, 5–6 mm longae.

Epiphyte; stems usually less than 10 cm long, ca. 1 cm diam.; roots thin, green, descending; cataphylls moderately thin, 3–3.5 cm long,

rounded at apex, drying medium brown, splitting at base, the apex remaining more or less intact. LEAVES erect-spreading; petioles (5–)8–20(–28) cm long, 3–5 mm diam., sulcate, the margins sharp; geniculum 1.7–2.5 cm long; blades medium thick, oblong-elliptic to narrowly elliptic, short to gradually acuminate at apex, acute to attenuate at base, 6.5–27 cm long, 3–7 cm wide, broadest at middle or slightly below; upper surface matte to semiglossy, obscurely glandular-punctate (drying blackish green or dark brown), lower surface semiglossy, paler, densely dark, glandular-punctate (drying brownish); midrib convexly raised above, becoming more acute, then diminishing and sunken at apex; convexly raised below; primary lateral veins 6–10 per side, departing midrib at ca. 60°, sunken in valleys above, raised below, more or less straight to collective vein; interprimary veins obscure above and below; collective vein arising from the base sunken above, raised below, 1–5 mm from margin. INFLORESCENCE spreading; peduncle 13–29 cm long; ca. 3 mm diam., sometimes faintly tinged reddish, terete or obscurely 3–4-ribbed, 2–5 times longer than petioles; spathe moderately thin, pale green, sometimes tinged reddish, lanceolate to ovate, 1.8–3.2 cm long, 0.5–1.2 cm wide, broadest at the base, acuminate at apex, rounded to obtuse at base, inserted at 45° angle on peduncle; spadix pale green (B & K Yellow-green 7/10), scarcely tapered, 3–6.5 cm long, 4–5 mm near base, 2.5–3.5 mm diam. near apex; flower rhombic to 4-lobed, 3–4 mm in both directions, the sides more or less straight, 2–3 flowers visible in the principal spiral, 4–5 visible in alternate spiral; tepals semiglossy, minutely papillate, the outer margins conspicuously raised giving spadix a cobbled texture; lateral tepals ca. 1.5 mm wide, the inner margin more or less straight; pistils raised, green; stigmas ellipsoid, 0.4–0.5 mm long, green, brush-like, exserted; stamens emerging from the base in a regular sequence, one or both lateral stamens exposed before alternates emerge, briefly exposed then retracted, faintly visible below surface of tepals; anthers pale yellow; pollen cream. INFRUCTESCENCE with berries pale lavender to whitish, depressed-globose, 5–6 mm long, 10–11 mm wide; seeds 4, ovoid, greenish, 2.3–2.5 mm long, 1.1–1.7 mm wide, 1–1.3 mm thick (possibly immature). Figs. 49 and 50.

Anthurium crassitepalum is endemic to Panama in the Serranía de Pirre of Darién Province from 1,100 to 1,600 m in premontane and lower montane rain forest.

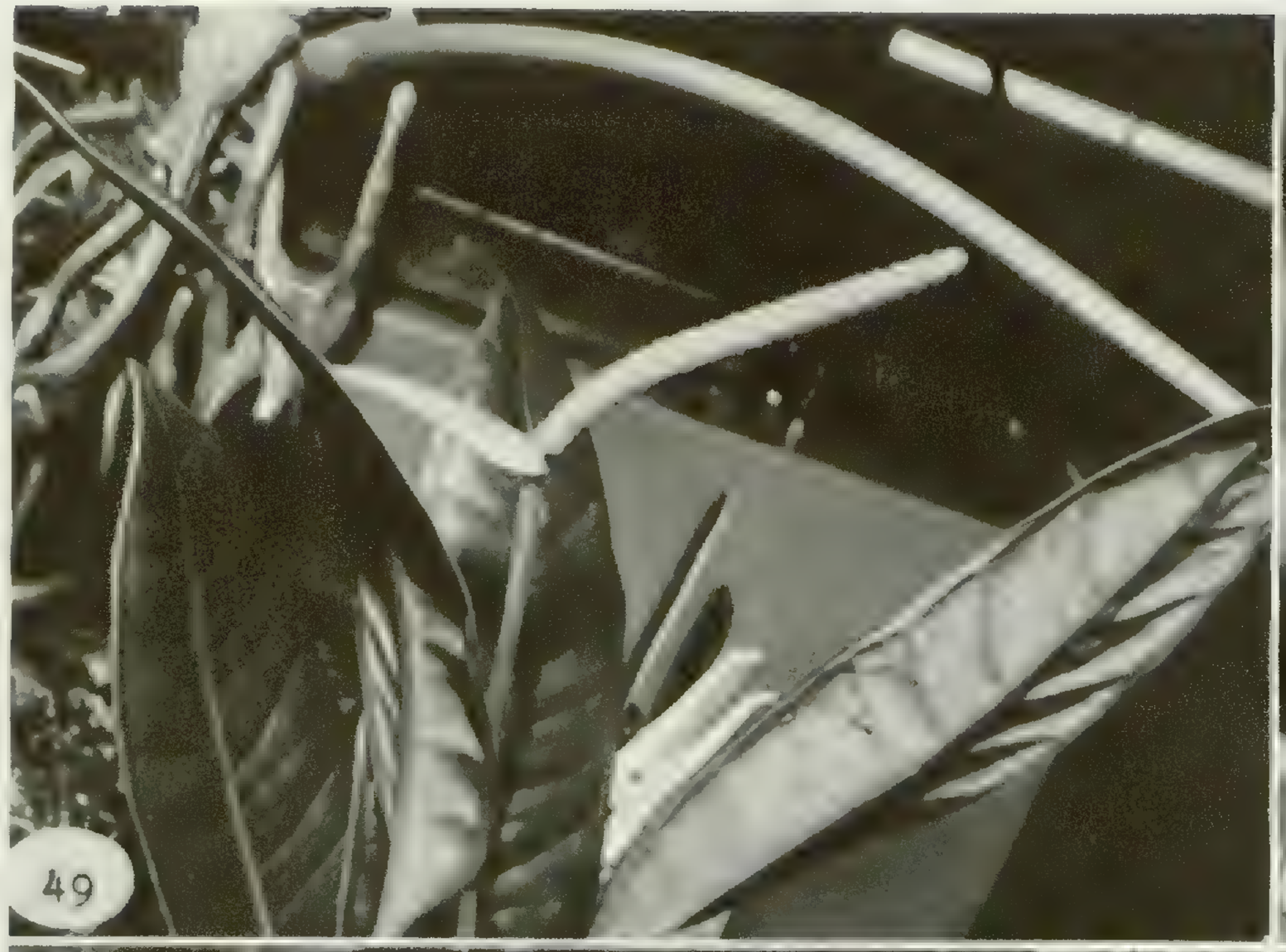
The species is a member of section *Porphyrochitonium* and is distinguished by its oblong-elliptic, glandular-punctate, gradually acuminate leaves, which are acute to attenuate at the base with sunken primary lateral and collective veins and especially by its greenish yellow spadix with the tepals being much thickened and slightly turned up along their outer margins giving the surface a texture comparable to a cobblestone street. The name *crassitepalum* refers to the thickened tepals.

The species is most easily confused with smaller leaved plants of *Anthurium pirrense* with which it occurs; this confusion arises because the two species have petioles and leaf shapes that are similar and the leaves of both dry blackish green to dark brown on the upper surface and brownish beneath. *Anthurium pirrense* usually has much larger, more coriaceous blades that dry with a prominently raised collective vein, whereas *A. crassitepalum* has the collective drying flat. *Anthurium pirrense* also differs in having a much longer, relatively more slender spadix that soon turns orange-brown and has a purplish ring around the pistil owing to the coloration of the inner margin of the tepals.

Anthurium crassitepalum also has leaves similar to those of *A. pageanum*; the latter species, however, has primary lateral veins more deeply sunken, a petiole that is sharply triangular with sharply erect margins (rounded abaxially with inconspicuous margins on *A. crassitepalum*) and especially a comparatively smoother spadix with tepals not markedly thickened or turned up marginally. Because of their small size, two other species in section *Porphyrochitonium, A. terryae* and *A. tacarcunense,* can be confused with *A. crassitepalum.* Both are distinguished by having leaf blades usually broadest above the middle and by having the flowers dry semi-intact (e.g., tepals not greatly distorted).

DARIÉN: Cerro Pirre, *Folsom & Mauseth 8576* (MO); Serranía de Pirre, vicinity Alturas de Nique, *Croat 37839, 37876, 37883* (MO), *37902, 37948* (MO, PMA).

Anthurium crystallinum Linden & André, Linden Cat. 90: t. 128. 1873. TYPE: The description was based on a plant collected by Wallis and cultivated in Brussels by Linden; the illustration in Ill. Hort. (20: t. 128. 1873) serves as the type.



FIGURES 49–52. 49. *Anthurium crassitepalum* Croat, *Croat 37948*.—50. *Anthurium crassitepalum* Croat, *Croat 37902*.—51. *Anthurium cinereopetiolatum* Croat, *Croat 35868*.—52. *Anthurium cucullispathum* Croat, *Folsom 3251A*.

Epiphyte; stem to 25 cm long, 2–2.5 cm diam., green; internodes very short; leaf scars 1.5–1.7 cm wide; roots short, thick, descending; cataphylls subcoriaceous, 3.5–6 cm long, narrowly apiculate at apex, drying medium brown (B & K yellow 4/5), apex persisting intact, splitting at base. LEAVES spreading; petioles terete, sometimes tinged red-violet at base; geniculum 1.4–3 cm long; blades held more or less parallel to stem, narrowly ovate to ovate, moderately thin, abruptly acuminate at apex, deeply lobed at base, 25–39 cm long, 15.3–22.2 cm wide, broadest at middle or just below; anterior lobes 20–33 cm long, the margins rounded; posterior lobes 5.5–10 cm long (from apex of sinus to outermost point); sinus obovate to triangular, sometimes closed (rarely with the margins fused, blade peltate), acute or obtuse to narrowly rounded at apex; upper surface matte, velvety, minutely papillate; lower surface matte, densely and obscurely speckled reddish brown; midrib convex, weakly raised above, flat toward middle, scarcely sunken toward apex, acutely raised below; basal veins 4–5 pairs, first to third free to base, the remainder coalesced ca. 1.5 cm, all major veins (including some secondary veins) much paler and outlined by a pale area on blade surface; posterior rib naked, weakly turned up; primary lateral veins 1–3 per side, departing midrib at 40–45° angle, straight toward collective vein, then curving upward toward apex; interprimary veins scarcely visible; secondary veins conspicuous especially at base of blade; collective vein arising from the first basal vein or one of the primary lateral veins, usually forming an acute angle with the margin, loop-connecting the primary lateral veins. INFLORESCENCE erect-spreading; peduncle (10–)24–28 cm long, 4–5 mm diam., terete, sometimes tinged red-violet; spathe subcoriaceous, green, heavily tinged red-violet, oblong-lanceolate, 7–9.3 cm long, 1.5–2.1 cm wide, broadest just above base, gradually acuminate at apex, rounded at base; inserted at 38–45° angle on peduncle; spadix green turning yellow, gradually tapered toward apex, 9–12 cm long, 5–6.5 mm diam. near base, ca. 4 mm diam. near apex; flowers square to sub-4-lobed, 2.5–3.5 mm in both directions, the sides more or less straight to jaggedly sigmoid, 3–5 flowers visible in either spiral; tepals glossy, lateral tepals 1.1–1.7 mm wide, the inner margin broadly rounded; pistils weakly emergent, green; stigma oblong-linear, 0.4–0.6 mm long; stamens emerging promptly from base, the laterals emerging nearly to apex before the third and fourth emerge at base; anthers yellow, held in a tight circle around pistil, ca. 0.4 mm long, 0.9 mm wide; thecae ovate, scarcely divaricate; pollen pale yellow. INFRUCTESCENCE with spadix to 12 cm long, 12 mm diam.; berries narrowly ovoid, white tinged violet purple, beaked at apex, ca. 1 cm long, 3–4 mm diam.; mesocarp juicy, clear with whitish raphide cells. Fig. 62.

Anthurium crystallinum was collected originally in the area of Nueva Granada (probably Colombia) in South America; however, more recently it has been collected from Panama where it is known only from premontane rain forest in the vicinity of Cerro Pirre at about 1,400 m.

The species is a member of section *Cardiolonchium* and is distinguished by its deep green, velvety blade that has a paler venation surrounded by a pale green area outlining the veins and by its yellow spadix with a faint pleasant aroma as the stamens emerge.

It is most closely related to *Anthurium papillilaminum* from lower elevations in the vicinity of the isthmus. The latter species differs in being terrestrial, having a green spadix at anthesis and especially in lacking the pale discolored areas bordering the major veins of the upper blade surface.

One collection (*Sheffer 175*), believed to be this species, was prepared from a cultivated plant at the University of Hawaii. It is unusual in exhibiting a weakly peltate leaf blade and in having unusually large flowers (3.2–6 mm long). The closed sinus on this plant corresponds better to the type illustration than the *Folsom* collections, which have a more open sinus, but the collection is believed to represent material also collected on or near Cerro Pirre by Dr. Sandy Fairchild (and later given to Dr. H. Kamemoto at the University of Hawaii).

No type specimen has ever been located nor have any Colombian collections been seen. No collections have been seen that correspond well with the illustration by Linden and André (Ill. Hort. 24: t. 128. 1877), which shows a closed sinus divided all the way to the petiole. The species was no doubt widely cultivated in Europe during Engler's time and his annotations clearly show that he accepted as part of *A. crystallinum* many specimens that had a relatively open sinus (such as the collections from Cerro Pirre). The Sheffer (*175*) collection comes closest to matching the type except for the fact that the blade

tissue is fused for about 1 cm at the apex of the sinus.

DARIÉN: base of Cerro Pirre near Piji Vasal (cultivated at Cheekwood Botanical Garden), *Folsom 4206* (MO), *4449* (MO, PMA, US), *Folsom & Mauseth 8516* (MO); origin uncertain but believed to be from Cerro Pirre (cultivated at the University of Hawaii), *Sheffer 175* (MO).

Anthurium cuasicanum Croat, sp. nov. TYPE: Panama. Darién: Serranía Pirre, Cuasí-Cana Trail between Cerro Campamiento and La Escalera to "Paramo" of Tres Bocas, *Kirkbride & Duke 1267* (MO 2132030, holotype; NY, isotype).

Planta epiphytica; cataphyllum findens persistens in fibris tenuibus; petiolus teres aut obtuse aut anguste sulcatus, 3–13 cm longus; lamina subcoriacea, anguste lanceolata, raro anguste oblongo-elliptica; basi obtusa ad anguste subrotundata, raro acuta, (6.5–)8–16.5 cm longa, (1.5–)2.8–5.3 cm lata, utrinque conspicue glanduloso-punctata; inflorescentia foliis longiora; pedunculus teres, 22–35 cm longus; spatha viridis, interdum suffusa rubra, lanceolata, 2.5 cm aut longior; spadix viridis aut rubens aut brunneus, 6–13 cm longus; baccae plus minusve globosae, aurantiacae, 5–6 mm diam.

Epiphyte; stem short, 1 cm diam.; internodes short; roots relatively few, slender; cataphylls promptly weathering to fine, tan, persistent fibers. LEAVES more or less erect; petioles terete or obtusely or narrowly sulcate, 3–13 cm long, usually two-thirds to three-fourths as long as the blades, rarely one-fourth longer than blade; blades subcoriaceous, narrowly lanceolate, rarely narrowly oblong-elliptic, gradually acuminate at apex, obtuse to narrowly rounded at base, rarely acute, (6.5–)8–16.5 cm long, (1.5–)2.8–5.3 cm wide, usually broadest in the lower one-third, rarely at the middle; both surfaces semiglossy, conspicuously glandular-punctate; the midrib prominently raised on both surfaces; primary lateral veins 5–7 per side, departing midrib at 35–45° angle (drying etched into surface above, prominulous below); straight or weakly curved distally to the collective vein; interprimary veins present, slightly less prominent than the primary lateral veins; collective veins arising from the base, the primary collective vein etched above, prominulous below, 1–5 mm from the margin, a secondary collective vein sometimes developed in lower one-fourth of blade. INFLORESCENCE usually much longer than the leaves; peduncles 22–35 cm long, terete; spathe green, sometimes tinged with red, lanceolate, acuminate at apex, 2.5 cm or more long, inserted at ca. 45° angle, soon deciduous, weakly decurrent; spadix sessile, green to reddish or brownish, slender, scarcely tapered toward apex, 6–13 cm long, 2–3 mm diam. (dried); flowers rhombic, 3–3.5 mm long, 2–2.5 mm wide, 2–3 flowers visible in the principal spiral, 4–5 flowers visible in alternate spiral; the lateral tepals 1.5–1.7 mm wide, the inner margin broadly rounded, the alternate tepals with the inner margins concave; stamens retracted beneath the tepals after anthesis. INFRUCTESCENCE with berries more or less globose, bright orange, 5–6 mm diam., mesocarp with pale, more or less ellipsoid raphide cells; seeds 4, ellipsoid, 1.7–2 mm long, 1.7–1.9 mm diam., 0.6–1 mm thick, pale brown, rounded at base, weakly sunken at apex, without any sign of appendages. Fig. 34.

Anthurium cuasicanum is endemic to Panama in Serranía de Pirre in Darién Province at elevations of up to 1,500 m. The Kirkbride and Duke collections were made at unknown elevations but presumably well above 1,000 m.

The species is distinguished by its relatively small size, its short stems with persistent, fine, pale cataphyll fibers, its petioles two-thirds as long as to rarely longer than the blades, its subcoriaceous, glandular-punctate, lanceolate and gradually acuminate blades, and by the long pedunculate inflorescence much surpassing the leaves with its thin, lanceolate, usually deciduous spathe, its long, slender, scarcely tapered green to reddish spadix, and its orange berries.

The species is similar to several other members of section *Porphyrochitonium* with more or less lanceolate, glandular-punctate leaf blades, including *Anthurium tutense, A. gracilispadix,* and *A. gracililaminum. Anthurium tutense* is distinguished by its generally smaller leaves with weakly sunken (etched) veins on the upper surface (dried), its more prominent collective vein, and especially by its short, generally stubby inflorescence and red berries. *Anthurium gracilispadix* differs in having thinner, usually oblong-elliptic leaf blades and a green or yellow-green, gradually tapered spadix with light green berries. *Anthurium gracililaminum* differs in having a relatively short, stubby spadix and white to pinkish white berries.

Because they occur together, *Anthurium cuasicanum* may possibly be confused with *A. terryae*; *A. terryae,* however, usually has much

shorter petioles, many, thin, mostly oblanceolate blades that dry grayish green rather than brown, and short, stubby, green spadices.

Croat 37950 differs from the other collections in having narrowly oblong-elliptic blades, broadest at about the middle, but it may be a younger plant.

DARIÉN: Cuasí-Cana Trail, E of Tres Bocas, *Kirkbride & Duke 1267, 1323* (MO, NY); SW ridge leading to Alturas de Nique on border with Colombia, *Hartman 12396* (MO); Serranía de Pirre, N of Alturas de Nique, *Croat 37950* (MO).

Anthurium cubense Engl., Bot. Jahrb. Syst. 25: 364. 1898. TYPE: Cuba. Ad Monte Toro, 300 m, *Eggers 5402* (K, holotype; B, isotype).

Epiphytic or terrestrial; to 40 cm tall; stem short, to 3 cm diam.; cataphylls drying brown, remaining more or less intact and persisting between leaves; petioles 5–10 cm long, 5–11 mm diam., subterete or obscurely quadrangular, broadly sulcate; blades oblanceolate-elliptic, subcoriaceous, obtuse to narrowly rounded at base, 26–38 cm long, 9–25 cm wide. Inflorescence erect; peduncle 8–16 cm long, 5–6 mm diam., terete, spathe subcoriaceous, subovate, olive green, tinged with violet purple at margins, 2.5–16 cm long, 0.6–5 cm wide; spadix cylindroid, 5.5–10 cm long, 0.8–1 cm diam. midway, white or lavender; berries red, oblong-elliptic, 9–12 mm long, 4.5–6 mm diam.; seeds 1–2. See Croat (1983: 284) for a more complete description.

Anthurium cubense is found in Cuba, Yucatán, and drier parts of eastern Guatemala on the Atlantic slope and from Nicaragua to Panama along the Pacific slope. The species is also known from northern Colombia and northwestern Venezuela. It is known from tropical dry forest and drier parts of tropical moist forest from 100 to 700 m. The species is apparently rare in Central America except in Nicaragua where it is locally common.

Anthurium cubense is in section *Pachyneurium* and is recognized by its short petioles, its short inflorescences, its cylindroid, pale violet purple spadix usually weakly tapered toward both ends, and by its bright red berries.

CHIRIQÚI: between Gualaca & Fortuna at Río Estí, *Croat 48793* (FTG, MO); E of Remedios, *Nee 10104* (MO).

Anthurium cucullispathum Croat, sp. nov. TYPE: Panama. Coclé: Alto Calvario, forest around Rivera sawmill, New Works, 7 or more km N of El Copé, 700–900 m, 8°40′N, 80°38′W, *Folsom 3251* (MO 2603116, holotype; B, PMA, US, isotypes; Live at MO).

Planta epiphytica; cataphyllum membranaceum, subpersistens intactum; petiolus erectus et effusus, teres, (4–)10–29 cm longus; lamina anguste ovata ad ovato-triangulata, modice coriacea, basi cordata, 11–38 cm longa, 5–23 cm lata, pagina inferiore inconspicue glanduloso-punctata; inflorescentia effusa et nutans; pedunculus teres, 17–52 cm longus; spatha pallide viride, subcoriacea, lanceolata ad late lanceolata, spadix cucullatus, 5.5–14 cm longa, cremeus, 3–9 mm longus; baccae rubrae aurantiacae, 6–7 mm longae.

Epiphyte; stems thick, less than 10 cm long, 3.5 cm diam.; internodes short; leaf scars ca. 1.5 cm wide; roots green, smooth, descending; cataphylls thin, 8–12.5 cm long, acute at apex (apiculum subapical); drying dark brown to reddish brown (B & K Yellow 4/2.5), remaining intact, subpersistent. LEAVES with petioles erect-spreading, (4–)10–29 cm long, terete; geniculum 0.5–2.5 cm long, scarcely thicker and paler than petiole; blades narrowly ovate to ovate-triangular, moderately thick, long-acuminate at apex (the acumen minutely inrolled) shallowly to deeply lobed at base, 11–38 cm long, 5–23 cm wide, broadest at point of petiole attachment; anterior lobe 10.5–30 cm long, the margins straight to broadly convex; posterior lobes 2.5–8 cm from apex of sinus to outermost point; sinus parabolic to hippocrepiform, acute to rounded at apex; upper surface semiglossy, with sparse, conspicuous raphide cells, lower surface more or less glossy, with inconspicuous, round, gland-like punctae; midrib convexly raised to middle above, diminishing and sunken toward apex, convexly raised below; basal veins 3–5 pairs, first and second free to base, those remaining briefly coalesced, weakly sunken to flat above, flat to prominulous below; posterior ribs absent, the outer margin flat to weakly turned up; primary lateral veins 6–15 per side, departing midrib at 45–55° angle, weakly sunken to flat above, flat to weakly raised below, more or less straight to collective vein, interprimary veins few, scarcely visible, flat; lesser veins visible on drying; collective vein arising from the first basal vein or one of the primary lateral veins 4–7 mm from the margin, loop-connecting the primary lateral veins, weakly sunken above, prominulous below.

INFLORESCENCE spreading, nodding, as long as or longer than leaves; peduncle terete, 17–52 cm long, up to 5 times longer than petioles; spathe subcoriaceous, pale green (B & K Green 7/10), lanceolate to broadly lanceolate, held cupped over nodding spadix, 5.5–14 cm long, 2.5–3.5 cm wide, broadest at base to near middle, long-acuminate at apex (the acumen inrolled its entire length), rounded to truncate at base, inserted at 60° angle on peduncle; spadix creamy white, weakly tapered at both ends, 3–9 cm long, 7–9 mm diam. midway; flowers 4-lobed, 1.8–2 mm long, 2.2–2.4 mm wide, the sides jaggedly sigmoid, 7–8 flowers visible in the principal spiral, (10–)12–14 flowers visible in the alternate spiral; tepals matte, minutely and densely papillate, lateral tepals 0.8–1.1 mm wide, the margins convex; pistils scarcely emergent, white; stigmas scarcely visible, elliptic; stamens emerging from the base, usually progressing to the third or fourth spiral before spathe fully opens, lateral stamens emerging first, quickly followed by alternates; anthers white, 5–6 mm long, 6–8 mm wide, held over pistil; thecae elliptic, not at all divaricate; pollen white. INFRUCTESCENCE pendent; berries red-orange, paler at base, 6–7 mm long, 4–5 mm diam., mesocarp gelatinous; seeds 2, 3–3.2 mm long, 2.1–2.5 mm diam., 1.2–1.3 mm thick, enveloped in a sticky gelatinous envelope. Figs. 52 and 53.

Anthurium cucullispathum is known from Panama in Chiriquí, Veraguas, Coclé, Panamá, and Darién Provinces at elevations as low as 350 m in Veraguas to as high as 1,500 m in Darién. It is found in tropical wet to lower montane rain forest life zones.

The species is a member of section *Calomystrium* and can be recognized by its narrowly ovate to ovate-triangular (more than two times longer than broad), moderately thick blade, its nodding inflorescence with a creamy white spadix, and by its pale green spathe that is held cupped over the spadix. It is also distinguished by usually having the stamens emerge promptly after the spathe opens or sometimes even before the spathe opens. The cucullate nature of the spathe gives the species its name.

Although *Anthurium cucullispathum* is vegetatively similar to several species in section *Calomystrium*, it is not confused with any others when flowering.

CHIRIQUÍ: Cerro Colorado, *Sullivan 293* (MO).
COCLÉ: NE slopes of Cerro Caracoral, *Sytsma 3762* (MO); vicinity Cerro Pilón, *Correa 36* (MO, PMA), *Croat 37484* (MO), *Sullivan 517* (MO); N of El Copé, *Croat 44730* (MO), *Folsom 3251* (B, MO, PMA, US), *6212* (MO), *Hammel 2402* (MO, PMA), *4165* (MO); top of El Potroso, *D'Arcy 11355* (MO); N of Llano Grande, *Hammel 1961* (MO); N of Penonomé, *Hammel 1631* (MO); La Pintada to Coclecito, *Hammel & Kress 11285* (DUKE).
COLÓN: SW of Cerro Bruja, *Sytsma et al. 4301* (MO); end of Santa Rita Road, *Knapp & Schmalzel 5224* (MO).
DARIÉN: Cerro Pirre, *Duke & Elias E13800* (MO); Serranía de Pirre, *Croat 37791* (MO), *37895* (MO, PMA).
PANAMÁ: trail to top of Cerro Pelado, *Antonio 1085* (MO); El Llano-Cartí Road, *Folsom et al. 5772* (MO).
VERAGUAS: vicinity Santa Fe, *Antonio 1847* (MO), *Croat 27475A, 48927, 49043* (MO), *48897* (MO, PMA), *Croat & Folsom 34137* (MO), *Liesner 910* (MO, PMA), *Mori et al. 3902, 3979* (MO).

Anthurium cuneatissimum (Engl.) Croat, Ann. Missouri Bot. Gard. 70: 285. 1983 [1984]. *Anthurium consobrinum* var. *cuneatissimum* Engl., Pflanzenr. 4(23B): 176. 1905. TYPE: Costa Rica. Limón: Llanuras de Santa Clara, 250 m, *Donnell-Smith 6811* (B, holotype; US, isotype).

Epiphyte; stems very short; cataphylls drying tan, weathering into longitudinal fibers; petioles usually quadrangular with sharp edges, sometimes bluntly angular abaxially, often with a sharp medial rib abaxially, 6–32(–40) cm long, 5–7 mm wide; blades obovate-elliptic, subcoriaceous; (20–)25–60 cm long, 8.5–21 cm wide, acute to cuneate at base. Inflorescence erect-spreading; peduncle 21–58 cm long, sharply 1-ribbed abaxially, 2–4-ribbed from base to just above middle; spathe ovate, cucullate, dark green, coriaceous, 2.5–6(–9) cm long, 2.1–4 cm wide; spadix sessile, white to pale yellow-green or lemon yellow, 1.9–5 cm long, ca. 8 mm diam. midway; berries greenish yellow to white, ovoid, 4–4.3 mm long, 2.5 mm thick; seeds 2. See Croat (1983: 285) for a more complete description.

Anthurium cuneatissimum is known from Nicaragua to Panama in tropical wet forest life zones from 20 to 450 m in Costa Rica and Nicaragua and at much higher elevations (800 to 1,000 m) in Panama.

The species is in section *Pachyneurium* and is distinguished by its long, sharply margined petiole, its broad leaf blade, its cucullate, coriaceous, ovate spathe, and its short, clavate, lemon yellow to white spadix.

The species may be confused with *Anthurium*

FIGURES 53–56. 53. *Anthurium cucullispathum* Croat, *Croat 27475.*—54. *Anthurium curvispadix* Croat, *Croat 44730.*—55. *Anthurium dwyeri* Croat, *Croat 33712.*—56. *Anthurium dwyeri* Croat, *Croat 34301.*

spathiphyllum where they occur together, such as at the La Selva Preserve in Costa Rica. Both species have a short clavate spadix, but *A. spathiphyllum* differs in having narrower leaves with 20–30 prominently sunken primary lateral veins (versus five to 15 scarcely sunken veins in *A. cuneatissimum*). In addition, *A. spathiphyllum* commonly has three-sided petioles and a spathe that is lanceolate and about twice as long as the spadix. In *A. cuneatissimum,* the spathe is ovate and as long as the spadix.

COCLÉ: vicinity Limón, N of El Copé, *Folsom 5815* (MO, PMA).

COLÓN: area of Río Miguel near Guásimo, *Croat 9902* (MO, PMA, SEL).

Anthurium curvilaminum Croat, sp. nov. TYPE: Panama. Coclé: along ridge N of sawmill above El Copé, 930–1,200 m, *Hammel 3544* (MO 2658913, holotype; K, PMA, isotypes; Live at MO).

Planta epiphytica aut epipetra; cataphyllum modice coriaceum, persistens in fibris grossis; petiolus leviter et obtuse sulcatus, 5–17 cm longus; lamina coriacea, oblongo-lanceolata ad raro anguste elliptica, costa manifeste arcuata, basi acuta, 25–52 cm longa, 6–14 cm lata, pagina inferiore conspicuo glanduloso-punctata; inflorescentia erecta-effusa; pedunculus teres, 16–30 cm longus; spatha viridis suffusa rubro-violacea, lanceolata ad oblonga, 3.5–9 cm longa, 1–3 cm lata; spadix purpureus, 5–11 cm longus; baccae subglobosae, rubrae.

Epiphytic or epipetric herb; stems short, less than 15 cm long, 1.5–2.5 cm diam.; internodes short; leaf scars inconspicuous; roots spreading or descending, 2–3 mm diam.; cataphylls moderately thick, narrowly acuminate at apex, drying reddish brown, weathering to coarse, persistent fibers. LEAVES with petioles erect, 5–17 cm long, 7–10 mm diam., rounded abaxially, shallowly and bluntly sulcate adaxially; geniculum 1–2 cm long, only slightly paler and thicker than the petiole; blades coriaceous, oblong-lanceolate to rarely narrowly elliptic, prominently arched along the midrib (sometimes forming an arc equalling half of a circle), short-acuminate at apex, acute at base, 25–52 cm long, 6–14 cm wide usually broadest just above the middle, the margin markedly revolute, not at all undulate; upper surface semiglossy, lacking glandular-punctations, drying with numerous, pale raphide cells visible; lower surface much paler, densely and conspicuously glandular-punctate; midrib broadly raised at base above, diminishing and sunken to near apex, convexly raised (to 0.8 mm) below; primary lateral veins 12–20 per side, departing midrib at 40–60° angle, running straight to the collective vein, weakly etched to weakly sunken above, flat to prominulous below, drying prominulous to prominent above, flat to prominulous below; interprimary veins weakly visible on both surfaces, drying more or less as prominent as the primary lateral veins; collective vein arising from the base, 7–10(–16) mm from the margin, etched or weakly sunken above, drying prominently sunken above, prominent below. INFLORESCENCE erect-spreading, shorter than the leaves; peduncle 16–30 cm long, 5–7 mm diam., 2–3 times longer than the petioles, terete; spathe green tinged with red-violet, lanceolate to oblong, 3.5–9 cm long, 1–3 cm wide, broadest near middle or below, obtuse to rounded and cuspidate at apex (the tip inrolled along its margins), acute at base, the margins rolled under, meeting unequally at base, inserted at 60° on peduncle; spadix violet purple (B & K Blue-purple 5/2.5), weakly tapered, bluntly rounded at apex, 5–11 cm long, 8–10 mm diam. near base, 5–7 mm diam. at apex; flowers 4-lobed, 2.2–2.5 mm long, 2.5–2.8 mm wide, the sides jaggedly sigmoid, 8–13 (mostly 9) flowers visible in the principal spiral; tepals glossy, the lateral tepals 1.2 mm diam., 5–6-sided, the inner margin obtusely angular; pistil not emergent before anthesis of stamens, then hidden by the stamens; stamens emerging promptly, beginning from the base, the lateral stamens emerging throughout the length of the spadix before the alternates emerge; anthers 0.3 mm long, 0.6 mm wide, lavender, held in a tight cluster over pistil; thecae ellipsoid, widely divaricate; pollen lavender, fading white. INFRUCTESCENCE with berries subglobose, red, ca. 5–6 mm diam.; seeds brown, 3–3.2 mm long, 2.4 mm diam., 1.7 mm thick, obovoid-elliptic, narrowly rounded at base and oblique, truncate or weakly sunken at apex with a short, translucent appendage. Figs. 60 and 61.

Anthurium curvilaminum is endemic to Panama. All collections to date are from the area near the Continental Divide north of El Copé in Coclé Province at 750 to 950 m in premontane rain forest or from the Serranía de Cañasas in an area of tropical wet or premontane rain forest at 400 to 700 m. Specimens from the latter area are often described as having a reddish spadix but also purple. No live material of these is yet available and dried specimens show no significant

FIGURES 57–60. 57. *Anthurium curvispadix* Croat, *Croat 33654.*—58. *Anthurium dwyeri* Croat, *Croat 34301.*—59. *Anthurium curvispadix* Croat, *Croat 34294.*—60. *Anthurium curvilaminum* Croat, *Hammel 3544.*

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FIGURES 61–64. 61. *Anthurium curvilaminum* Croat, *Hammel 3544.*—62. *Anthurium crystallinum* Linden & André, *Folsom 4206.*—63, 64. *Anthurium folsomianum* Croat, *Kamemoto 280.*

differences between the two areas. Nevertheless, further studies with material from the Serranía de Cañasas could show it to be distinct.

Anthurium curvilaminum is in section *Porphyrochitonium.* It can easily be confused with larger leaved specimens of *A. bakeri,* but the latter has generally thinner blades and always has a white spadix that is not strongly scented at anthesis. The spadix of *A. curvilaminum* is strongly aromatic, smelling vaguely of vanilla during the middle part of the day.

Anthurium curvilaminum is perhaps also related to *A. redolens* from the Serranía del Sapo, which also has leaves lacking glands on the upper surface and an aromatic, violet purple spadix, but that species has sunken primary lateral veins, and the spadix yields a different aroma.

COCLÉ: vicinity El Copé, *Croat 44739, 49170* (MO), *Folsom 1236, 5727* (MO), *Folsom & Robinson 2383* (MO), *Hammel 3544* (K, MO, PMA).

PANAMÁ: vicinity Pilota del Toro, *Folsom 4986* (MO), *Folsom et al. 6820* (MO); vicinity Rancho Chorro, mountains above Tortí-Arriba, *Folsom et al. 6710* (MO).

Anthurium curvispadix Croat, sp. nov. TYPE: Panama. Colón: Santa Rita Ridge Road, along trail at end of road that goes to Río Indio, beginning 10.6 km from Transisthmian Hwy., 3 km beyond hydrographic station, ca. 380 m, *Croat 34294* (MO 2399525, holotype; PMA, SEL, US, isotypes; Live at MO).

Planta epiphytica; cataphyllum subcoriaceum, persistens intactum; petiolus teres, 13–59 cm longus; lamina ovato-triangulata ad late ovata, subcoriacea, illae plantarum amplas bullatae, basi cordata, 18–61 cm longa, 12–40 cm lata; inflorescentia erecta-effusa; pedunculus teres, 21–64 cm longus; spatha subcoriacea, pallide albido-viridis, lanceolata; spadix cremeus, 11–18 cm longus; baccae basi albae, apice pallide viridis, ca. 7 mm longae.

Epiphyte; stems 5–10 cm long, ca. 3 cm diam.; leaf scars 2–2.3 cm wide; roots numerous, green, medium thick; cataphylls subcoriaceous, 11–18 cm long, rounded to obtuse at apex (the acumen apiculate to 6 mm), drying brown (B & K Yellow 4/2.5), persisting intact. LEAVES erect-spreading; petioles 13–59 cm long, 0.6–1 cm diam., terete; geniculum 2–6 cm long, sometimes weakly sulcate; blades ovate-triangular to broadly ovate, subcoriaceous, becoming bullate in larger plants, gradually long-acuminate to abruptly long-acuminate at apex, prominently lobed at base, 18–61 cm long, 12–40 cm wide; broadest at point of petiole attachment or below; anterior lobe 14–40 cm long, the margins convex, the posterior lobes 7–21 cm long (from apex of sinus to outermost point); sinus hippocrepiform; acute at apex; upper surface semiglossy with numerous, conspicuous raphide cells; lower surface matte to semiglossy; midrib convexly raised above, narrowing and weakly sunken toward apex, convexly raised below; basal veins 4–9 pairs, the first, sometimes second, free to base, those remaining coalesced 1.2–4.5 cm, raised above and below, flat or weakly sunken toward margin; posterior rib naked, the outer margin turned up; primary lateral veins 3–8 per side, departing midrib at 35–65° angle, straight to weakly arching near collective vein, flat above, prominulous below; lesser veins obscure above, visible and flat below, more prominent in larger blades; collective vein arising from the first basal vein, loop-connecting the primary lateral veins, flat to weakly sunken above, prominulous below, 5–16 mm from the margin. INFLORESCENCE erect-spreading; shorter to longer than leaves; peduncle 21–64 cm long, 8–15 mm diam., terete; spathe subcoriaceous, pale whitish green (B & K Yellow-green 8/10–9/10), lanceolate, 13–24 cm long, 1.5–4 cm wide, broadest just above base, long-acuminate at apex, obtuse to acute at base, inserted at ca. 70° angle on peduncle; spadix cream-colored, 11–28 cm long, 8–15 mm diam. at base, 5–11 mm diam. at apex, tapered toward apex; flowers 4-lobed, 2.3–2.8 mm in both directions, the sides straight to sigmoid, 8–9 flowers visible in the principal spiral, 9–12 flowers visible in the alternate spiral; tepals matte, densely and minutely papillate, lateral tepals 1–1.6 mm wide, the inner margin more or less straight to broadly rounded; pistils white, emergent; stigma ellipsoid ca. 0.3 mm long, raised, brush-like; stamens emerging from the base, laterals emerging nearly to apex before alternates emerge, sometimes the laterals emerging in a scattered manner throughout spadix; anthers creamy white, held at edge of tepals against emergent pistil, 0.4–0.5 mm long, ca. 0.7 mm wide; thecae ovate, moderately divaricate; pollen white, dispersing over tepals. INFRUCTESCENCE pendent; berries white at base, pale green at apex; ca. 7 mm long; seeds 1–2, oblong-elliptic, ca. 5–6 mm long. Figs. 54, 57, and 59.

Anthurium curvispadix is known from Veraguas, Coclé, Colón, Panamá, and Darién Prov-

inces in Panama, from 25 m in Colón along the Río Guanche to 1,300 m in Veraguas north of Sante Fe. It is found in tropical wet, premontane rain, and lower montane rain forest life zones.

The species is a member of section *Calomystrium* and is distinguished by its broadly ovate to ovate-triangular blades, its long, tapered, generally curved, creamy white spadix, and its moderately thick, pale whitish green, recurved spathe. *Anthurium curvispadix* could be confused with *A. hoffmannii,* but that species, which occurs in Panama only in Chiriquí, has a much shorter, less tapered spadix.

The material represented here may ultimately prove to be two species as one living collection (*Croat 33966,* included in this description) consistently flowers with a very distinct pleasant aroma from mid-morning to mid-afternoon that lasts for up to a week, whereas other living collections studied had no obvious aroma. In one case, *Croat 34294,* a faint rose-like aroma was present.

Two collections, *Liesner 1212* and *Hammel 4755,* differ in having a second collective vein arising from the second basal vein and extending to the apex.

COCLÉ: road between La Pintada & Coclecito, *Croat 49238A* (MO); vicinity of El Copé, *Croat 44730A* (MO), *Folsom 3252* (MO, PMA, US), *Hammel 2365* (MO).
COLÓN: between Portobelo & Río Cascajal, *Croat 33654* (MO, PMA, US); Río Guanche, *Hammel et al. 4909* (MO), *Mori & Kallunki 5191* (MO, PMA); Santa Rita Ridge Road, *Croat 34294* (MO, PMA, SEL, US).
DARIÉN: ridge leading to Alturas de Nique, *Hartman 12282* (MO); Cerro Pirre, *Bristan 492* (MO); NE slope of Summit Cerro Sapo, *Hammel 7292* (MO).
PANAMÁ: road to Cartí, N of El Llano, *Busey 884* (MO); El Llano-Cartí Road, *Liesner 1212* (MO).
VERAGUAS: vicinity Santa Fe, *Croat & Folsom 33966* (MO, US), *Croat 49042* (MO), *Hammel 4755* (MO).

Anthurium cuspidatum Mast., Gard. Chron. 3: 428. 1875. TYPE: Colombia? Hort. Vietch., Jan. 1875 (K).

Anthurium talamancae Engl., Bot. Jahrb. Syst. 25: 386. 1898. TYPE: Costa Rica. Limón: Talamanca, near Shirores, 100 m, *Tonduz 9233* (B, hololectotype; designated by Croat & Baker, 1979).
Anthurium donnell-smithii Engl., Bot. Jahrb. Syst. 25: 389. 1898. TYPE: Costa Rica. Limón: Rio Jiminez, Llanos de Santa Clara, 280 m, Apr. 1894, *Donnell-Smith 4979* (B, holotype; US, isotype).
Anthurium orteganum Engl., Bot. Jahrb. Syst. 25: 387. 1898. TYPE: Colombia. Cauca: near Popayán, 1,500–1,700 m, *Lehman 5989* (B, holotype; F, K, isotypes).
Anthurium johnii Engl., Pflanzenr. 4(23B): 119. 1905.

TYPE: Costa Rica. Suerre: Llanos de Santa Clara, 300 m, *Smith 6812* (B).

Epiphyte or terrestrial; stems often to 50 cm long, ca. 3 cm diam.; cataphylls drying pale reddish brown, weathering into fibers; petioles terete, (11–)30–118 cm long, (3–)4–12 mm diam.; blades usually ovate-oblong, sometimes narrowly ovate, moderately chartaceous, truncate to subcordate to rarely prominently lobed at base, (16–)25–62 cm long, (6–)11–40 cm wide. Inflorescence erect-spreading; peduncle 28–75 cm long, terete; spathe membranous, oblong-lanceolate, pale green, sometimes tinged purple, (6.5–)7.5–18 cm long, (1.3–)1.8–2.5 cm wide; spadix green to usually dark violet purple, 6.5–18 cm long; berries reddish, ovoid-ellipsoid, 6–8 mm long, ca. 5.3 mm wide. See Croat (1983: 287) for a more complete description.

The species is found from Nicaragua to Ecuador at elevations from 400 to 1,700 m or rarely lower in very wet areas, premontane wet, tropical wet, premontane rain, and lower montane rain forest life zones. It is one of the more common species of *Anthurium.*

Anthurium cuspidatum is in section *Pachyneurium* and is distinguished by its thin, usually oblong-ovate blades with many veins (these often drying reddish brown or with purplish splotches on the blade), its long, slender, weakly tapered, violet purple spadix, and its early exserted, oblong, red berries.

Anthurium cuspidatum is superficially close to *A. williamsii* of Costa Rica, Panama, and northwestern South America with which it shares a nearly identical inflorescence and similar thin, veiny leaves. *Anthurium williamsii* differs in having supervolute vernation and a more ovate blade with more basal veins that are free or nearly free to the base.

BOCAS DEL TORO: 10–15 mi. inland (S) from Changuinola River, *Lewis et al. 987* (MO); Chiriquicito, S along Río Guarumo, *Lewis et al. 2023* (UC, US); Quebrada Huron, *Kirkbride & Duke 439* (MO).
CHIRIQUÍ: vicinity Fortuna Dam site, *Antonio 4071, 5080* (MO), *Croat 48683, 50096* (MO), *Folsom et al. 5506* (MO), *Hammel 2153* (MO); slope NW of confluence of Río Hornito & Río Chiriquí, *Stevens 18373* (MO).
COCLÉ: Alto Calvario, *Folsom & Robinson 2420, 2427* (MO), *Folsom 5821* (MO); vicinity Cerro Caracoral, *Knapp 1071, 1095* (MO), *Sytsma 4061* (MO); vicinity Cerro Pilón, above El Valle de Antón, *Croat 37343* (MO), *Dwyer 4531* (MO), *Mori 6582* (MO), *Porter et al. 4655* (MO), *Sullivan 488* (MO); N of turnoff to

Coclecito from Llano Grande, *Hammel 1790, 1976* (MO); vicinity El Copé, *Antonio 1180* (MO), *Croat 44559, 44594, 44722* (MO), *Folsom 1244, 1294, 3221* (MO), *Folsom & Lantz 1878, 1878A* (MO), *Hammel 774, 2359, 2407, 3319, 3468, 3469, 3526* (MO), *Sytsma 2591* (MO), *Sytsma & Andersson 4612* (K, MO); vicinity El Valle de Antón, *Lewis et al. 1721* (MO), *Spellman et al. 610* (MO); N of Penonomé, *Hammel 1677* (MO); along Río San Juan below its junction with Río Tife, *Hammel 3398, 3415* (MO).

COLÓN: S approach of Cerro Bruja from Río Escandaloso, *Hammel 3114, 3158, 3161* (MO); Río Escandaloso near abandoned mine, *Hammel 2675* (MO); upstream from bridge over Río Guanche, *Antonio 3368* (MO); vicinity Río Indio on road from Portobelo to Nombre de Dios, *Croat 33644* (MO, PMA).

DARIÉN: N of Cerro Pirre, *Folsom et al. 6288* (MO); Serranía de Pirre, N of Alturas de Nique, *Croat 37874* (MO); vicinity gold mining camp of Tyler Kittredge, *Croat 27165* (MO).

PANAMÁ: Cerro Jefe, *Sheffer 232, 266* (MO).

SAN BLAS: El Llano-Cartí Road, *Sytsma & Andersson 4460* (MO).

VERAGUAS: road between Escuela Agricola Alto Piedra & Rio Calovébora, *Croat & Folsom 25901, 34145, 34148* (MO), *33962* (MO, PMA); vicinity Escuela Agricola Alto Piedra near Santa Fe, *Antonio 3481, 3522, 3962* (MO), *Croat 25580, 27324* (MO), *Mori & Kallunki 3260* (MO); vicinity Santa Fe, *Croat 23182, 23220, 25602, 25605, 25623* (MO), *Folsom 2956, 2978* (MO), *Gentry 2977* (MO), *Hammel 4717* (MO), *Liesner 895, 953* (MO), *Mori & Kallunki 6134, 6142, 6150, 6183* (MO), *Mori et al. 6697* (MO), *Mori 6708* (MO), *Mori & Bolten 7669* (MO), *Sytsma & Andersson 4778, 4781, 4784* (MO); Cerro Tute, *Croat 34232* (MO), *Mori 6241, 6287, 6291* (MO), *Mori et al. 7536, 7551, 7554* (MO), *Sytsma & Antonio 3030* (MO), *Sytsma & Andersson 4626* (DUKE, MO), *4673* (MO).

Anthurium davidsoniae Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 4. 1940. TYPE: Panama. Chiriquí: Bajo Chorro, Boquete Dist., 1,800 m, 17 Jan. 1938, *Davidson 134* (F 915728, holotype; MO, US, isotypes).

Usually terrestrial, rarely epiphytic; stems elongate, less than 1 cm diam.; cataphylls drying reddish brown; petioles shallowly sulcate with sharp marginal ribs adaxially, 13–27 cm long, 2.5–3.5 mm wide; blades ovate to narrowly ovate, more or less chartaceous, usually conspicuously bullate, 15–23 cm long, 9.5–15.5 cm wide, shallowly and broadly lobed at base. Inflorescence erect; peduncle 9–19 cm long; spathe lanceolate, pale green, 3–5 cm long; 5–10 mm wide; spadix pale yellow-green, 2–4 cm long, 5–7 mm diam. at base; berries greenish yellow; seeds obovoid. See Croat (1983: 288) for a more complete description.

Anthurium davidsoniae is known from Costa Rica and Panama from 1,300 to 2,000 m in premontane rain and lower montane rain forest.

The species is in section *Xialophyllium* and is recognized by its thin, prominently veined, often bullate leaf blades, its elongate stems, its green spadix, and its greenish yellow berries.

The species is related to both *Anthurium pallens* and *A. microspadix,* though more closely to the latter. All of these species share a similar habit with elongate stems and a similar inflorescence. *Anthurium davidsoniae* differs from both by having a much broader, more ovate, more conspicuously bullate leaf blade.

CHIRIQUÍ/BOCAS DEL TORO: Cerro Colorado, *Folsom et al. 4675* (MO); near peak of Cerro Pata de Macho, *Hammel 5812* (MO).

CHIRIQUÍ: Bajo Chorro, Boquete Dist., *Davidson 134* (F, MO, US), *Woodson & Schery 691* (MO); Cerro Colorado, *Antonio 1465* (MO), *Croat 37153, 48442, 48456* (MO); SE slopes & summit of Cerro Pata de Macho, *Sytsma et al. 4897* (MO); Fortuna Dam site, *Hammel 2167* (MO); vicinity Monte Azul, E slopes of Cerro Punta, *Croat 48592* (MO); between Quebrada Hondo & Continental Divide, *Kirkbride & Duke 926* (MO, NY).

Anthurium dichrophyllum Croat, sp. nov. TYPE: Panama. Veraguas: trail up E side of Cerro Tute, to 1,200 m, 8°33′N, 81°08′W, *Witherspoon & Dressler 8870* (MO 2300839, holotype; PMA, isotype).

Planta epiphytica; cataphyllum persistens plus minusve intactum aut findens in fibris tenibus; petiolus ellipticus, 15–23 cm longus; lamina modice membranacea, lanceolato-oblonga ad oblongo-elliptica, basi anguste ad late acute, 18–21 cm longa, 4.5–5.8 cm lata, utrinque glanduloso-punctata; inflorescentia et pedunculus 20–23 cm longus; spatha viridis, oblongo-lanceolata, 2.5–3 cm longa, 5–6 mm lata; spadix ignotus per anthesin; baccae albae, 3–4 mm diam.

Epiphyte; stems short, ca. 1 cm diam.; internodes short, leaf scars hidden by cataphylls; roots moderately few, slender; cataphylls 1.5–2 cm long, drying reddish brown, remaining more or less intact or weathering to slender fibers. LEAVES erect; petioles 15–23 cm long, 2–3 cm diam., about as long as or longer than the blades, elliptic in cross-section; geniculum 1–1.5 cm long; blades oblong-lanceolate to oblong-elliptic, moderately thin on drying, gradually long-acuminate at apex, narrowly to broadly acute at base, 18–21 cm long, 4.5–5.8 cm wide, the upper surface drying dark green, sparsely and conspicuously glandular-punctate with sunken epidermal cells, the lower surface much paler, densely and conspicuously

glandular-punctate; midrib prominently raised on both surfaces; primary lateral veins 5–6 per side, drying scarcely or not at all more prominent than the numerous interprimary veins, weakly curved to the collective vein, weakly loop-connected, both the primary lateral and interprimary veins prominulous on both surfaces (dry); collective vein arising from the base, 2–4 mm from the margin, drying weakly sunken above, prominulous below. INFLORESCENCE with peduncle 20–23 cm long, usually longer than the petioles; spathe green, oblong-lanceolate, 2.5–3 cm long, 5–6 mm wide, broadest just above the base, obtuse at apex and apiculate, acute and weakly decurrent at base, inserted at ca. 45° angle on peduncle; spadix oblong, scarcely tapered, spadix at anthesis not known, ca. 3 flowers visible in principal spiral, 5–6 in alternate spiral (young infructescence); lateral tepals 1.2–1.7 mm wide, the inner margins thin, almost straight, the surface coarsely granular-punctate. INFRUCTESCENCE with spadix ca. 5 cm long, ca. 1.5 cm diam.; berries white, 3–4 mm diam., mesocarp gelatinous, with numerous raphide cells, these about as broad as long; stigma weakly raised; seeds 2, tan, ovoid to ellipsoid, somewhat flattened, 2.2–3 mm long, 1.4–1.8 mm diam., 0.4–0.8 mm thick, enveloped in a gelatinous sac, this somewhat elongate at the broadest end of the seed. Fig. 69.

Anthurium dichrophyllum is endemic to Panama and known only from Cerro Tute in Veraguas Province in premontane rain forest at 1,100 to 1,200 m.

The species is a member of section *Porphyrochitonium* and is distinguished by its oblong-lanceolate to oblong-elliptic, long-petiolate, narrowly acuminate, glandular-punctate leaf blades that dry markedly bicolorous (thus the name *dichrophyllum*) with the primary lateral veins scarcely or not at all more prominent than the interprimary veins. It is also distinguished by its relatively short, stubby spadix and white berries.

It is most easily confused with *Anthurium gracililaminum* from Chiriquí Province, which has similarly shaped glandular-punctate leaf blades. The latter species has leaf blades that are much less markedly bicolorous and are eglandular or only inconspicuously glandular-punctate on the upper surface with the glands only a few times broader than the surrounding raphide cells. In *A. dichrophyllum,* the glands are conspicuous on the upper surface and many times larger than the surrounding raphide cells. *Anthurium gracililaminum* also differs in having pinkish white berries.

VERAGUAS: E side of Cerro Tute, *Witherspoon et al. 8856, 8870* (MO, PMA).

Anthurium dressleri Croat, Aroideana 1: 54. 1978. TYPE: Panama. Colón: Río Guanche, upstream ca. 5 km above bridge along road to Portobelo, ca. 200 m, *Croat 37000* (MO 2395460, holotype; F, K, PMA, SCZ, SEL, US, isotypes; Live at MO).

Terrestrial; stem to ca. 25 cm long, 1–2.3 cm diam.; roots moderately few, brown, slender; cataphylls pale green, to 6 cm long, acuminate at apex, drying brown, persisting at upper nodes. LEAVES with petioles erect-spreading; blades held more or less perpendicular to petiole; petioles several ribbed, 8–40 cm long, 5–7 mm wide, narrowly to broadly sulcate adaxially (sometimes bluntly medially ribbed), the adaxial surface sometimes purplish; blades narrowly ovate, acute to acuminate at apex, deeply lobed at base, 20–40 cm long, 11.5–30 cm wide, broadest near the middle; anterior lobe 21–32 cm long, the margins convex; posterior lobes 5–10 cm long, sometimes overlapping, often turned up along inner margins; sinus spathulate, often closed, acute at apex; upper surface matte, dark green, velvety; lower surface matte, much paler; midrib raised above, acutely raised below; basal veins (3–)4–5(–6) pairs, free to base, raised above and below; primary lateral veins 5–6 per side, departing midrib at ca. 55° angle, raised above and below; interprimary veins flat, darker than surface; collective vein arising from the first basal vein, 4–9 mm from the margin. INFLORESCENCE erect, shorter than the leaves; peduncle terete or with several sharp ribs, tinged purple, 7.5–17 cm long; spathe moderately thin, white or geenish white, narrowly ovate to lanceolate, 4.2–8 cm long, 1–3.5 cm wide, broadest in the lower one-third, acuminate to caudate-acuminate at apex, obtuse to cordate at base, inserted at 35° angle on peduncle; spadix pale yellow to yellowish green (B & K Yellow-green 9/2.5), 3.5–7.5 cm long, 6–7 mm diam. at base, 4–5 mm diam. at apex; flowers weakly 4-lobed, 2.5–3.2 mm long, 2.5–3 mm wide, the sides straight to jaggedly sigmoid, ca. 6 flowers in the principal spiral, ca. 10 flowers in the alternate spiral; tepals glossy, weakly punctate, minutely papillate, lateral tepals 0.7–1.5 mm wide, the inner margin broadly convex; pistils

green, semiglossy, weakly emergent; stigma ellipsoid, 0.4–0.5 mm long, brush-like with droplets for ca. 1 week before stamens emerge, drying brown; lateral stamens emerging in a rapid sequence from the base, the alternate pairs emerging much later; anthers 0.4–0.5 mm long, ca. 0.8 mm wide, held above the edge of tepals, not completely emergent from beneath tepals; thecae not divaricate; pollen white. INFRUCTESCENCE pendent, to 13 cm long, 1.7 cm diam.; berries irregularly dispersed, obovoid, dark violet purple in apical one-third, white to greenish below, 6–8 mm long, 5 mm diam., round to mamilliform at apex; seeds 2, 4–5 mm long, ca. 3 mm wide, obovoid, white (turning green in age) one end oblique, enveloped in a semi-translucent appendage. Figs. 65 and 66.

Anthurium dressleri is known from Panama and Colombia in tropical wet and premontane rain forest from 150 to 180 m.

The species is in section *Cardiolonchium* and is similar to *Anthurium crystallinum* but differs from that species in having a markedly winged petiole and a concolorous upper blade surface (i.e., lacking whitish major veins). *Anthurium crystallinum* generally has a terete petiole, leaf blades with prominently paler major veins and, according to Birdsey (1951) and Engler (1905), orange anthers. *Folsom 3747,* studied live at MO, had yellow anthers. The anthers of *A. dressleri* are white.

CANAL ZONE: Pipeline road, *Antonio 1300* (MO).
COLÓN: road from Colón to Portobelo, *Folsom 3737* (MO); along Río Escandaloso near Río Boquerón, *Antonio 1310* (MO), *Hammel 2664, 4001* (MO); Río Guanche, *Croat 37000* (F, K, MO, PMA, SCZ, SEL, US), *Foster 2808* (MO), *Kennedy & Mori 3463* (F, MO); below Cerro Bruja along Río Escandaloso beyond Mino #2, *Kress & Knapp 82-1392* (DUKE, MO).
PANAMÁ: Cerro Jefe, *Madison 3741* (MO, SEL); El Llano-Cartí Road, *Croat 49130A, 49144* (MO), *Nee 10492* (MO).

Anthurium dukei Croat, sp. nov. TYPE: Panama. Darién: Cerro Campamento, S of Cerro Pirre, cloud forest, *Duke 15572* (MO 2897078–80, holotype; US, isotype).

Planta epiphytica; cataphyllum persistens in fibris grossis longitudinalis; petiolus 65–75 cm longus; lamina membranacea, ovato-triangulata, basi profunde cordata, 56–85 cm longa, 24–55 cm lata; inflorescentia elongata, pedunculus 51–64 cm longus; spatha viridis, oblongo-lanceolata, 15–35 cm longa, 2.5–4 cm lata; spadix rufus ad marroninus, 15–32 cm longus, in fructus 38–67 cm longus; baccae rubrae, oblongo-ellipticae.

Epiphyte, ca. 1 m tall; stems ca. 2.5 cm diam.; cataphylls 13–30 cm long, drying tan, weathering to coarse longitudinal fibers, persisting. LEAVES with petioles 65–75 cm long, 8–9 mm diam., sometimes with many low ridges; blades thin, ovate-triangular, long-acuminate at apex, deeply lobed at base, 56–85 cm long, 24–55 cm wide, broadest at point of petiole attachment; anterior lobe 40–52 cm long, the margins straight to convex; posterior lobes 14.5–25 cm long; sinus hippocrepiform, the apex rounded; both surfaces drying matte; midrib raised above and below; basal veins 6–8 pairs, the first and second, sometimes third, free to the base, the fourth and higher coalesced 2.5–5 cm or more, raised above and below (dry); posterior ribs broadly curved, naked for most of the length; primary lateral veins 12–20 per side, departing midrib at 45–55° angle, straight or weakly arching to collective vein, raised above and below, yellow below (dry); interprimary veins as prominent as primary lateral veins (dry); collective veins arising from one of the lowermost basal veins, loop-connecting the primary lateral veins, prominulous above, raised and yellow below (dry), 2–4 mm from the margin, sometimes only scarcely removed from margin. INFLORESCENCE with peduncle 51–64 cm long; spathe green, 15–35 cm long, 2.5–4 cm wide, oblong-lanceolate, moderately thin; spadix reddish to maroon, 15–32 cm long, 1.5–2.5 cm diam. near base, 0.7–1 cm diam. near apex; flowers (post-anthesis) rhombic to 4-lobed, 1.5–2.2 mm long, 1.2–2.7 mm wide, the sides straight to smoothly sigmoid, 8–12 flowers visible in the principal spiral, 13–19 flowers visible in the alternate spiral; lateral tepals 0.8–1 mm wide, the inner margin convex. INFRUCTESCENCE 38–67 cm long, 3–3.5 cm diam. with berries exserted; berries red, oblong-elliptic, ca. 1 cm long, moderately acute at apex. Figs. 70 and 72.

Anthurium dukei is known only from Panama in Darién Province in tropical wet and premontane rain forest at 600 to 1,600 m.

The species is tentatively placed in section *Belolonchium* and is recognized by its large, green-drying, relatively thin, ovate-triangular leaves with numerous primary lateral veins and with the interprimary veins only slightly less conspicuous than the primary lateral veins. Other distinguishing features include its thin lanceolate spathe and very long infructescence with red berries. Also characteristic is the way the collective vein extends uniformly close to the margin of

the blade after arising usually from the lowermost basal vein.

Anthurium dukei is similar to *A. rotundistigmatum* in terms of leaf blade shape and color, but the latter differs in having the collective vein generally arising from one of the primary lateral veins and in having a short-pendunculate inflorescence. It may be confused with *A. panamense* from Coclé and Veraguas Provinces, but that species has a more elongate blade and a creamy white spadix.

The species was first collected by R. S. Williams in 1908; *A. williamsii,* named in honor of the same collector, precludes naming this species in his honor. It was later collected by Dr. James A. Duke in 1968 during his explorations of Darién. The type specimen was collected by Duke and is named in his honor.

DARIÉN/CHOCÓ (COLOMBIA): Alturas de Nique, southernmost peak of Cerro Pirre massif, *Gentry et al. 28701* (MO).

DARIÉN: Cerro Campamento, *Duke 15572* (MO, US); summit of Cerro Pirre, *Gentry 4595* (MO); E of Tres Bocas, *Kirkbride & Duke 1161* (MO).

Anthurium dwyeri Croat, Selbyana 5: 323. 1981.

TYPE: Panama. Colón: Santa Rita Ridge, along trail at end of road to Río Indio, beginning 10.6 km from the Transisthmian Hwy., ca. 380 m, *Croat 34301* (MO 2399063, holotype; K, PMA, US, VEN, isotypes; Live at MO).

Epiphyte; leaf scars obscured by dense roots and persistent cataphyll fibers; roots numerous, 2–5 mm thick; cataphylls moderately thin, 5–7 cm long, acuminate at apex, quickly turning reddish brown, weathering to subpersistent fibers. LEAVES spreading; petioles 4–19 cm long, 5–9 mm wide, stiff, almost triangular, sharply acute abaxially, broadly and sharply sulcate adaxially with a faint medial rib; geniculum 1–2 cm long; blades oblong-elliptic, coriaceous, slightly arched along the midrib, acute to abruptly short-acuminate at apex (the acumen minutely apiculate), acute at base, 24–40 cm long, 6–11 cm wide, broadest near the middle or slightly above, the margin flat or broadly undulate; upper surface glossy, lower surface semiglossy, with moderately dense, dark glandular punctations; midrib convexly raised above, narrowing and diminishing towards apex, sharply acute below, usually with a distinct, erect rib; primary lateral veins 20–35 per side, departing midrib at ca. 60° angle, slightly sunken above, obscure below, more or less straight to the collective vein; collective vein arising from the base, mostly straight, 5–7 mm from margin, slightly sunken above, obscure below. INFLORESCENCE erect-spreading, shorter to longer than the leaves; peduncle 6–44 cm long, 4–8 mm wide, sharply triangular, the sharpest margin continuous with the decurrent edges of spathe, flexible to more or less stiff; spathe coriaceous, yellow-green, sometimes tinged purplish (B & K Yellow-green 7/10) at anthesis, lanceolate-elliptic to broadly lanceolate or oblong-elliptic, 3–11 cm long, 2.2–4.1 cm wide, broadest near point of insertion, short-acuminate at apex (the acumen hooked), acute and slightly inequilateral at base, decurrent 5–15 mm, inserted at 70° angle on peduncle, spreading, meeting on peduncle at 60–90° angle; the stipe 1–3 mm long in back, 6–9 mm diam., darker green than peduncle; spadix pale green (B & K Yellow-green 7/10) at anthesis, 7.5–16.5 cm long, 8–13 mm diam. at base, 5–9 mm diam. at apex; flowers square or rhombic to weakly 4-lobed, 3–4.1 mm long, 2.5–3.9 mm wide, ca. 6 flowers visible in the principal spiral, ca. 5 flowers visible in the alternate spiral, the sides straight to shallowly sigmoid; tepals green, semiglossy, the lateral tepals 2–2.2 mm wide; pistil weakly emergent at anthesis, pale green, the stigma oblong, with minute droplet just before pollen is visible, the droplets remaining after pollen appears; stamens never fully exserted, squeezing minute amounts of pollen out between tepals and pistil, the pollen held at edge of droplet; pollen white. INFRUCTESCENCE spreading to pendent, the spathe much shorter than the spadix, spreading; spadix 12–24 cm long, to 2.5 cm diam.; berries subglobose, flattened at apex, pale lavender white, ca. 7 mm long, 6–7 mm wide, 4–5 mm thick, with a whitish circular area ca. 2 mm wide around the stigma; seeds 6, narrowly ovoid, white, ca. 2 mm long. Figs. 55, 56, and 58.

Anthurium dwyeri is known from Panama and Colombia (Chocó) at 350 to 1,150 m in tropical wet and premontane rain forest.

The species is in section *Porphyrochitonium* and is distinguished by its coriaceous, oblong-elliptic blades that are punctate below, its sharply triangular petioles, its stout triangular peduncle, its pale green spadix, and its usually unexposed anthers that ooze pollen from beneath the tepals. It is also unusual because of its pale, lavender

white, subglobose berries that are flattened at the apex. The species has no known close relatives.

In rare cases, inflorescences are found that appear to lack stigmatic droplets and that have anthers exserted, laying flat against the pistil before opening. Both types of inflorescences were found on the same plant at the same time in the greenhouse at the Missouri Botanical Garden.

COCLÉ: La Mesa, *Folsom 5634* (MO); mountains beyond La Pintada, *Hunter & Allen 576* (MO); along Río San Juan below its junction with Río Tife, *Hammel 3400* (MO).

COLÓN: Santa Rita Ridge Road, *Croat 34301* (K, MO, PMA, US, VEN), *Gentry 6102* (MO), *Gentry et al. 8869* (MO), *Sytsma 2062* (MO), *Wilbur et al. 15069* (DUKE); S approach to Cerro Bruja from Río Escandaloso, *Hammel 3192* (MO).

DARIÉN: along headwaters of Río Tuquesa, *Croat 27135* (F, MO, PMA).

PANAMÁ: Cerro Jefe, *Dwyer & Gentry 10268* (MO), *Gómez-Pompa 3057* (MEXU), *Sytsma 1968* (MO); El Llano-Cartí Road, *Croat 25090, 34770, 34806* (MO), *Gentry et al. 8882* (MO), *Liesner 1166* (MO), *Tyson 7351* (MO); S of Goofy Lake, *Dwyer & Stimson 8063* (MO); vicinity Río Casada, *Correa & Dressler 1653* (MO).

Anthurium erythrostachyum Croat, sp. nov. TYPE: Panama. Darién: Serranía de Pirre, ca. 12 km due N of Alturas de Nique, 1,520–1,560 m, *Croat 37901* (MO 2416624, holotype; K, NY, PMA, SEL, US, VEN, isotypes; Live at MO).

Planta terrestris aut epiphytica; caudex elongatus, cataphyllum subcoriaceum, persistens intactum; petiolus teres aut obscure sulcatus, 19–62 cm longus; lamina subcoriacea, ovata ad ovata-triangulata, basi profunde cordata, 18–50 cm longa, 12–28 cm lata; inflorescentia erecta ad effusa; pedunculus teres, (8–)14–40 cm longus; spatha coriacea, pallide viridis, lanceolata, 5.5–16 cm longa; spadix roseus, pallide lavandulescens, 3.5–9 cm longus; baccae apice rubro-violaceae, basi albescentes.

Terrestrial or epiphytic; stems elongate, 10 cm or more long, 1.5–2 cm diam.; internodes to 1.5 cm long; closer near the apex; roots several at each node, gray-green to brown; cataphylls subcoriaceous, 12–17 cm long, acute at apex with minute subapical apiculum, drying brown (B & K Yellow 5/2.5), persisting intact at upper nodes, deciduous at lower nodes. LEAVES with petioles spreading, 19–62 cm long, terete to obscurely sulcate; geniculum 2–4 cm long; blades ovate to ovate-triangular, subcoriaceous, gradually long-acuminate to abruptly long-acuminate at apex (the acumen flat), broadly to deeply lobed at base, 18–50 cm long, 12–28 cm wide, broadest at base or at point of petiole attachment; anterior lobe 12–39 cm long, the margins broadly rounded; posterior lobes 5–16 cm from apex of sinus to outermost point; the sinus parabolic to hippocrepiform, rounded at apex; upper surface matte to semiglossy with conspicuous raphide cells, lower surface semiglossy; midrib raised above, diminishing and flat toward apex, convexly raised below; basal veins 4–7 pairs, the first and second free to base, the remaining coalesced to 3 cm, flat to sunken above, raised below, the posterior rib turned up weakly along the outer margin; primary lateral veins 4–6 per side, departing midrib at 35–45° angle, weakly arching to collective vein, sunken above, raised below; interprimary and secondary veins sunken above, more or less obscure below; collective vein arising from the first basal vein, loop-connecting the primary lateral veins, 5–10 mm from margin. INFLORESCENCE erect to spreading; peduncle (8–)14–40 cm long, 2–4 mm diam., terete, one-third to two-thirds as long as petiole; spathe subcoriaceous, light green (B & K Yellow-green 9/5–7/10), lanceolate, 5.5–16 cm long, 2–4.5 cm wide, broadest at base, caudate-acuminate at apex (acumen inrolled, to 3.5 cm long) obtuse to rounded at base, inserted at 30° angle on peduncle; stipe 1–3 mm long; spadix pink (B & K Red 8/5 to Red-purple 6/2.5), fading to a pale lavender (B & K Purple 7/5), scarcely tapered toward apex, 3.5–9 cm long, 5–10 mm diam. at base, 4–6 mm diam. at apex, sweet, minty scented at anthesis; flowers 4-lobed, 2.7–3.3 mm in both directions, the sides jaggedly sigmoid, 5–8 flowers visible in the principal spiral, 7–12 flowers visible in the alternate spiral; tepals glossy, smooth, lateral tepals 1–1.5 mm wide, the inner margin convex, the outer margin irregularly 4-sided; pistils weakly raised before emerging, white, glossy; stigmas linear 0.2–0.4 mm long, exserted, brush-like, drying brown before stamens emerge; stamens emerging in scattered manner, laterals first, followed quickly by alternates; anthers white, ca. 0.5 mm in both directions, held in a contiguous cluster over pistil; thecae ellipsoid, slightly divaricate; pollen white. INFRUCTESCENCE with acute violet purple berries, 9–9.5 mm long, 3.7–4 mm diam., elliptic; mesocarp syrupy with elongate raphide cells; seeds 1 (?), yellow, ca. 3.5 mm long, 2.5 mm wide. Figs. 73 and 74.

Anthurium erythrostachyum is known from

FIGURES 65–68. 65, 66. *Anthurium dressleri* Croat, *Croat 37000*. —67, 68. *Anthurium fusiforme* Croat, *Croat 33332*.

FIGURES 69–72. 69. *Anthurium dichrophyllum* Croat, *Witherspoon et al. 8870.*—70–72. *Anthurium dukei* Croat, *Duke 15572.*

FIGURES 73–76. 73. *Anthurium erythrostachyum* Croat, *Croat 37901.*—74. *Anthurium erythrostachyum* Croat, *Croat 37826.*—75. *Anthurium fendleri* Schott, *Croat 37051.*—76. *Anthurium gracililaminum* Croat, *Croat 49929.*

Panama in Darién Province and in Colombia in the Chocó region. It is found at elevations of 1,100 to 1,560 m in premontane rain and lower montane rain forest life zones.

The species is a member of section *Calomystrium* and can be recognized by its elongate stem with persisting, brown cataphylls, its ovate-triangular blade with conspicuous raphide cells on the upper surface, its pinkish spadix with glossy tepals and white, exserted pistils and by its pale green, caudate-acuminate spathe.

The species is not easily confused with any other member of section *Calomystrium.* It might be confused with *Anthurium roseospadix,* an endemic species that has a similarly colored spadix, but the latter is distinguished by having smaller, thicker leaves, a usually shorter, stouter stem, and a usually whitish spathe more abruptly acuminate with a relatively short acumen.

DARIÉN: vicinity Alturas de Nique, *Croat 37901* (K, MO, NY, PMA, SEL, US, VEN), *37879* (MO), *Gentry et al. 28646* (COL, F, MO, PMA), *Hartman 12410* (MO); Serranía de Pirre between Río Cana & Río Escucha Ruido, *Croat 37826* (F, MO, PMA, NY); Cerro Pirre, *Folsom 4293, 4348, 4479* (MO), *Folsom et al. 6303* (MO, PMA), *Folsom & Mauseth 8544* (MO).

Anthurium fatoense K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 11: 611. 1932. TYPE: Panama. Colón: Dos Bocas, Río Fato Valley, 40–80 m, *Pittier 4227* (US).

Rosulate epiphyte; stems to 60 cm long, ca. 1 cm diam.; cataphylls drying medium brown, persisting more or less intact; petioles quadrangular, sulcate, 2.5–5(–9.5) cm long, 5–7 mm wide; blades oblong-oblanceolate, acute at base, 24–83 cm long, 6–26 cm wide. Inflorescence erect-spreading to arching-pendent; peduncle 14–48 cm long; subterete, faintly ribbed; spathe pale green, sometimes tinged purplish, narrowly lanceolate, 5.5–9 cm long, 0.7–1.3 cm wide; spadix pale reddish or green tinged reddish, 5–15 cm long, 4–8 cm diam. at base; berries cream to greenish yellow or orange, oblong-ovoid, 4–7 mm long, acute at apex. See Croat (1983: 293) for a more complete description.

The species is known from southern Costa Rica and Panama, occurring principally on the Caribbean slope in wetter parts of tropical moist forest, as well as in tropical wet, premontane wet, and lower montane wet forest. The species ranges from near sea level to nearly 1,000 m. It also occurs on the Pacific slope in the Fortuna area of Chiriquí Province.

Anthurium fatoense is considerably variable in the size of the leaves and inflorescence as well as in berry color. It is in section *Pachyneurium* and is distinguished by its tapered, greenish spadix that has the stamens emerged in a close cluster with the pistil not at all apparent. It is most easily confused with *A. consobrinum,* but that species has prominently emergent pistils that emerge well ahead of the stamens and extend several millimeters above the stamens.

BOCAS DEL TORO: Cerro Banyic, *Kirkbride & Duke 606* (MO); Changuinola near Luzón, *Kennedy 3266* (F, MO); Chiriquicito, S along Río Guarumo, *Lewis et al. 2051* (MO); vicinity Chiriquí Lagoon, *Wedel 2350* (MO).

CHIRIQUÍ: vicinity Fortuna Dam site, *Antonio 5175* (MO), *Croat 48705* (MO), *48716* (FTG, MO), *49893* (FTG, MISSA, MO), *50095* (MO), *Folsom et al. 5293* (MO).

COCLÉ: Alto Calvario, *Folsom 3183* (MO); El Copé, *Hammel 2420, 2441* (MO); La Mesa, *Croat 37347* (MO), *Hammel 3902* (MO); vicinity Llano Grande near Continental Divide, *Antonio 1358, 3598* (MO), *Croat 49220* (MO), *D'Arcy & Sytsma 14690* (MO), *Hammel 1808, 1908* (MO), *3483* (MO, SEL), *Sytsma 3880* (MO); N of Penonomé, *Hammel 1619* (MO).

COLÓN: S approach to Cerro Bruja from Río Escandaloso, *Hammel 3197* (MO); headwaters of Río Boquerón, *Hammel 3947* (MO); Río Escandaloso, *Hammel 2661* (MO, SEL); Portobelo & Río Cascajal, *Croat 33649* (MO, PMA); San Lucas, *Hammel 4549* (MO).

VERAGUAS: slopes of Cerro Tute, *Croat 48940* (MO), *Sytsma & Antonio 3049* (MO), *3068* (K, MO), *Sytsma & Andersson 4658* (MO); vicinity Escuela Agricola Alto Piedra, near Santa Fe, *Antonio 4039* (MO); road between Escuela Agricola Alto Piedra & Río Dos Bocas, *Croat 25941, 27365, 27583, 27749* (MO); above Río Primero Brazo, *Croat 23115* (MO); vicinity Santa Fe, *Folsom 2949* (MO, PMA), *Gentry 2953* (MO), *Mori & Kallunki 2560* (MO), *Nee 9807, 11220* (MO); road from Santa Fe to Río Calovébora, *Croat & Folsom 34124* (CAS, COL, CR, DUKE, F, MO, PMA, US).

Anthurium fendleri Schott, Prod. Aroid. 468. 1860. TYPE: Venezuela. Colonia Tovar, *Fendler 1343* (K, hololectotype; GH, isolectotype; here designated).

Anthurium canasas Croat, Aroideana 2: 30. 1979. TYPE: Panama. Veraguas: Dist. Cañasas, ca. 1 km above Cañasas on road to Los Valles, 230 m, *Croat 37051* (MO, holotype; B, COL, F, PMA, S, SCZ, US, isotypes).

Epipetric, epiphytic or terrestrial on steep rocky banks; roots numerous, descending, 2–5 mm diam., densely pubescent; stem to ca. 15 cm long,

1–1.5 cm diam.; cataphylls to ca. 5 cm long, reddish mottled, drying brown, remaining more or less intact except at base, gradually acuminate at apex. LEAVES erect-spreading; petioles (2–)4–12 cm long, 5–7 mm diam., shorter than the leaves, narrowly to broadly and sharply sulcate, usually with 3–5 sharp, low ribs adaxially, the medial rib the most prominent; geniculum (0.5–)1–1.5 cm long; blades moderately thin, oblanceolate to oblanceolate-elliptic, gradually acuminate and often falcate at apex, acute to obtuse or narrowly rounded at base, (15–)30–65 cm long, (6–)10–18 cm wide, broadest above the middle; both surfaces semiglossy; the midrib raised above, flat at base, becoming convex, then diminishing at apex, prominently raised and narrowly acute below; primary lateral veins 8–12 per side, sunken in valleys above, raised below, arcuate-ascending, the lowermost free to margin, loop-connecting with collective vein in apical one-third of blade; collective vein arising from primary lateral vein near middle of blade. INFLORESCENCE spreading or stiffly erect; peduncle 30–75 cm long, terete, longer than petioles, weakly to prominently ribbed abaxially, sometimes adaxially; spathe thin, green or green suffused with violet purple, 6–11.5 cm long, 9–15 mm wide, broadest just above the point of petiole attachment, linear-lanceolate to narrowly triangular, narrowly acuminate at apex, obliquely inserted on peduncle at 60–80° angle, spreading and recurving or loosely coiled, joining the peduncle at 20–50° angle; stipe green, ca. 6–18 mm long abaxially, 22–33 mm long adaxially, 3.5–4 mm diam., spadix maroon (B & K Red-purple 2/10), 7.5–16 cm long, 4–7 mm diam. at base, 2.5–4 mm diam. at apex; flowers square to rhombic, 2.5–3 mm in both directions, the sides weakly sigmoid; 4–8 flowers visible in the principal spiral, 5–10 flowers visible in the alternate spiral; tepals matte, weakly punctate, minutely papillate, lateral tepals 1.3–1.8 mm long, the inner margins broadly convex to concave; pistils early emergent 0.1–0.2 mm, green becoming violet purple (sometimes green with violet purple splotches); the stigma light purple-violet, ellipsoid, 0.6 mm long, with conspicuous droplets over several days, 2–4 days before anthers emerge; dry and full of slightly exserted bristles when anthers open; becoming a dry, dark ditch when stamens emerge; stamens emerging in a slow progression from base, those in all but the leading 3–5 spirals completely developed; anthers cream, ca. 0.4–0.5 mm long, 0.8–0.9 mm wide, held just above the edge of the tepals, inclined slightly inward, quickly losing pollen; thecae brown, held flat at edge of pistil, not contiguous; pollen pale yellow, soon fading white. INFRUCTESCENCE pendent; usually developing berries only in the lower half of spadix; berries obovoid, violet purple, 6.7–7 mm long, rounded at apex, emerging in a more or less scattered pattern; mesocarp white, thickly gelatinous; seeds 1–2, purplish, 4.5–5 mm long, 2–3.5 mm wide, 0.7–2 mm thick. Fig. 75.

Previously known only from the northern cordillera of Venezuela west of Caracas, the species is now known to range into the Serranía de Perija in northeastern Colombia and southward along the edge of the eastern range of the Andes to the Departments of Meta and Vaupes in southwestern Colombia. Disjunct populations include those in the Chocó of Colombia, in the Serranía del Darién, and in central Panama on the Pacific slope near Cañasas in Veraguas Province. The species ranges from 100 to 500 m and occurs principally in areas known to be tropical moist forest.

It is a member of section *Pachyneurium* but differs from most members of that section in Central America because of its thinner leaves and violet purple berries.

Anthurium fendleri is distinguished by its rich green, oblanceolate-elliptic leaves that dry more or less olive green with prominent, raised reticulate venation and by its ribbed petioles, its slender reddish brown spadices, and its violet purple berries.

VERAGUAS: Dist. Cañasas, above Cañasas on road to Los Valles, *Croat 37051* (B, COL, F, MO, PMA, S, SCZ, US).

Anthurium flexile Schott, Oesterr. Bot. Z. 8: 180. 1858. TYPE: Costa Rica. Heredia: Pedregel, *Wendland 932* (GÖET, holotype).

Anthurium myosuroides (H.B.K.) Endl. var. *angustifolium* Engl., Bot. Jahrb. Syst. 25: 382. 1898. TYPE: Costa Rica. Limón: Matina, *Pittier 9797* (BR, CR, US).

Scandent epiphyte; the stem elongate; petioles 4–11 cm long, flattened to sulcate adaxially; blade elliptic or narrowly elliptic, (10–)13–26.5 cm long, (2.5–)3–9(–10.5) cm wide, narrowly subcordate, pliveined at base. Inflorescence usually arching-pendent; peduncle 4–23 cm long, terete; spathe green, lanceolate, 3.5–9.5 cm long, 0.7–1.8 cm

wide; stipe absent or to 2 mm long; spadix 4.5–13 cm long, 0.3–0.5 cm diam. at base; berries orange to red, oblong-ellipsoid to narrowly ellipsoid or narrowly ovoid (with 4 longitudinal ridges on drying), 0.5–1.2 cm long; seeds (1–)2(–3). See Croat (1983: 293) for a more complete description.

The species ranges from Mexico to Panama at 0 to 1,000 m in tropical wet forest life zones.

Anthurium flexile is a member of section *Polyphyllium* (Croat & Baker, 1978); it is distinguished by its scandent habit, its very slender stem (ca. 3 mm diam.) with tiny roots scattered along the internodes, its thin, more or less elliptic, cordate or subcordate blades, and by its unusually branched growth pattern that consists of sympodial branchlets each bearing one to six leaves above the bicarinate prophyll and terminating in an inflorescence. The lowermost internode of each renewal shoot is adnate to the internode between the penultimate leaf and the last leaf of the preceding shoot. In all other sections of *Anthurium* each branch of the stem ends with a single leaf and an inflorescence, although the stem branches are commonly so reduced that the branching is usually not apparent.

BOCAS DEL TORO: between Almirante & Changuinola, *Croat & Porter 16365A, 16405* (MO), *Kennedy 1307* (F); Water Valley, *Wedel 713, 978* MO).

CANAL ZONE: Barro Colorado Island, *Bailey & Bailey 517* (BH, F), *625* (F), *Starry 60* (F, MO).

CHIRIQUÍ: vicinity San Bartolo, Burica Peninsula, *Woodson & Schery 921* (MO).

COCLÉ: vicinity El Valle, *Allen 1186* (MO), *2715* (F), *Ebinger 1123* (MO); mountains beyond La Pintada, *Hunter & Allen 584* (MO).

DARIÉN: Boca de Pavarandó, on Sambú River, *Pittier 5574* (US); vicinity Campamento, Río Chucunaque above confluence of Río Tuquesa, *Stern et al. 869* (MO); road from El Real to Pinogana, *Duke 5016* (MO); between Paya & Palo de las Letras, *Duke & Kirkbride 14021* (MO); between Pinogana & Yaviza, *Allen 290* (MO); N of Púcro, *Duke 13035* (MO, OS); mouth of Río Yape, *Allen 345* (MO).

Anthurium folsomianum Croat, sp. nov. TYPE: Panama. Panamá: vicinity of Cerro Jefe, 4.6 km beyond peak on road to Altos de Pacora, 26.3 km from Pan-American Hwy., ca. 600 m, *Croat 35918* (MO 2381194, holotype; PMA, isotype).

Planta epiphytica aut terrestris; cataphyllum persistens intactum denique deciduum; petiolus teres aut obscure et anguste sulcatus, 8–19 cm longus, lamina subcoriacea anguste ovata ad ovato-triangulata, basi cordata, 12–22 cm longa, 7–13 cm lata; inflorescentia erecta ad effusa; pedunculus teres, 18–30 cm longus; spatha membranacea, viridis, oblongo-lanceolata, 5–10 cm longa, 11–15 mm lata; spadix viridis, 5.7–12 cm longus; baccae atropurpureae, ovoidae, apice anguste rotundae.

Epiphyte or terrestrial; stem creeping or erect, to ca. 1 m long, slender, brittle; internodes 1–7 cm long; leaf scars 1–1.5 cm diam.; roots 3–5 per node; cataphylls ca. 2.5 cm long, drying light tan, briefly persisting intact, then deciduous. LEAVES persisting at upper 5–6 nodes; petioles terete or obscurely and narrowly sulcate, 8–19 cm long, to 2.5 cm diam.; geniculum ca. 1 cm long; blades narrowly ovate to ovate triangular, subcoriaceous, long-acuminate at apex (the acumen moderately flat and apiculate), lobed at base, 12–22 cm long, 7–13 cm wide, broadest near the base; anterior lobe 11–15 cm long, the sides straight to weakly convex; posterior lobes 5–8 cm long (from apex of sinus to outermost point); sinus parabolic or hippocrepiform, obtuse to round at apex; both surfaces matte, upper surface velvety; the midrib acutely raised above and below, basal veins 4–6 pairs, 3–5 of them coalesced 1.5–4 cm; flat to prominulous above and below; primary lateral veins 6–7 per side, departing midrib at 40–50° degree angle, straight to collective vein, flat above, prominulous below, obscure above, darker than surface below, lesser veins obscure above, visible below; collective vein arising from the first basal vein, 3–10 mm from margin. INFLORESCENCE erect to spreading; peduncle 18–30 cm long, 2–5 mm diam., terete, longer than the petioles; spathe green, moderately thin, oblong-lanceolate, 5–10 cm long, 11–15 mm wide, broadest near the base, acuminate at apex, rounded at the base, inserted at ca. 40° angle on peduncle, the sides sometimes rolled under; stipe 1–3 mm long; spadix green, 5.7–12 cm long, 4–6 mm diam.; flowers rhombic, 2–2.2 mm long (dried), 1.7–1.8 mm wide, 5–7 flowers visible in the principal spiral; tepals semiglossy, drying with a few conspicuous raphide cells clearly visible, lateral tepals 1.2–1.6 mm diam., the inner margin broadly rounded; pistil not emergent; stamens emerging from the base in a relatively complete sequence with the lateral stamens preceding the alternates by only a few spirals; anthers ca. 0.8 mm long, 1 mm wide (dried), held just above the tepals and inclined inward over the pistil; thecae narrowly ovate, scarcely divaricate; pollen white. INFRUCTESCENCE spreading; spathe persistent; spadix to ca. 15 cm long, 2.5 cm diam.;

berries dark violet purple, ovoid, exserted and colored before maturity, narrowly rounded at apex; seeds not studied. Figs. 63 and 64.

Anthurium folsomianum is endemic to the Cerro Jefe region at 600 to 1,000 m in premontane rain forest. This attractive species is named in honor of James Folsom for his important role in providing many living collections of Panamanian aroids. Mention should also be made of the assistance of Dr. H. Kamemoto at the University of Hawaii who was the first collector of the species. Some of the details of the descripton were based on live plants at the University of Hawaii where the species is in cultivation (*Kamemoto 276, 280*).

The species is tentatively placed in section *Cardiolonchium* because of its velvety leaf blades but it shows little relationship to other members of the section in Panama, namely *Anthurium dressleri* and *A. papillilaminum*. In terms of its habit it might be more easily confused with *A. hutchisonii* (which dries blackened rather than green) or *A. leptocaule*. The latter differs in drying brown (rather than green as in *A. folsomianum*) and in having posterior lobes usually rounded or at least not much longer than broad (versus almost twice as long as broad in *A. folsomianum*).

The species is distinguished by its slender, gray, brittle stem, often with elongate internodes near the base, by its narrowly ovate-triangular, velvety leaves that are paler beneath with the veins darker than the matte surface, and by the slightly tapered green spadix, green lanceolate spathe, and violet purple berries.

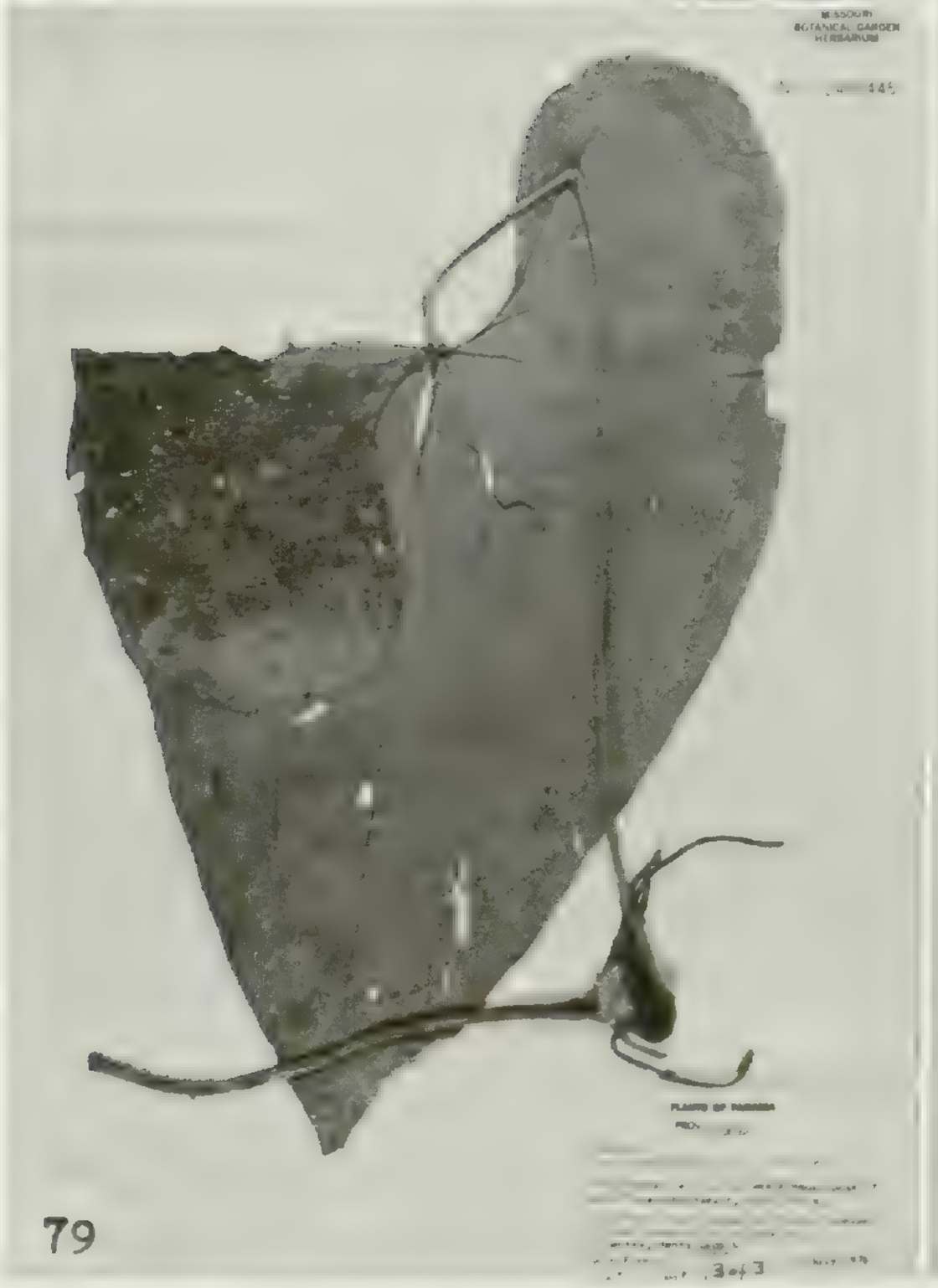
PANAMÁ: vicinity of Cerro Jefe, *Croat 35918, 45062* (MO), *49085* (MO, PMA), *Sheffer 181* (MO).

Anthurium foreroanum Croat, sp. nov. TYPE: Panama. Darién: elfin forest near top of westernmost peak of Cerro Tacarcuna massif (Serranía del Darién), 1,720 m, *Gentry et al. 16888* (MO 2400443, holotype; COL, PMA, isotypes).

Planta epiphytica; cataphyllum coriaceum persistens intactum, petiolus teres, 34–65 cm longus, lamina subcoriacea, ovata, basi profunde cordata, 19–39 cm longa, 12–23 cm lata; pedunculus teres, 35–46 cm longus; spatha alba, oblongo-lanceolata, (4–)6–8 cm longa, 1.2–2 cm lata; spadix rubrum, 4 cm aut longiore; baccae ellipsoidae, lavandulae, ca. 1 cm longae.

Epiphyte; stems 1–1.5 cm diam., internodes short near the apex, to 1 cm or more long in lower portion of stem; roots moderately few; cataphylls thick, 9–12 cm long, narrowly rounded at the apex with a short subapical apiculum, drying reddish brown and persisting intact. LEAVES with petioles terete, 34–65 cm long, 4–6 mm diam. midway; blades subcoriaceous, ovate-cordate, gradually to abruptly acuminate at apex, deeply lobed at base, 19–39 cm long, 12–23 cm wide, broadest at the point of petiole attachment, drying thinly coriaceous, grayish green; anterior lobe 14.5–30 cm long, broadly rounded along the margins; posterior lobes 6–13 cm long (from apex of sinus to outermost point), directed toward the base; the sinus hippocrepiform, 4–9 cm long, rounded at apex; both surfaces semiglossy, the upper surface usually with numerous, linear raphide cells; lower surface obscurely and densely brownish speckled; midrib and basal veins raised on both surfaces; basal veins 4–6, the first pair free or nearly so, the second pair nearly free, third to sixth coalesced 1–2.5 cm; primary lateral veins 3–5, departing midrib at 50–60° angle, weakly curved to the collective vein, drying prominulous, scarcely more prominent than the interprimary veins on drying; tertiary veins drying prominulous on both surfaces, more conspicuous below; collective vein arising from the first basal vein, usually forming an acute angle with the margin, more or less flat above, prominulous below. INFLORESCENCE with peduncle 35–51 cm long, ca. 5 mm diam., terete, slightly shorter to longer than the petioles; spathe white to pale green, oblong-lanceolate, (4–)6–8 cm long, 1.2–2 cm wide, broadest just above base, acuminate at apex (the acumen tightly inrolled), narrowly acute and weakly decurrent at base, inserted at 45° angle on peduncle, curled in fruit; spadix red, 4–6 cm long, 5–8 mm diam., slightly tapered to the apex; the flowers somewhat 4-lobed, 1.6–1.8 mm long, 1.8–2.3 mm wide (dried), 6–8 flowers visible in the principal spiral; tepals matte, the lateral tepals 0.9–1.1 mm wide, the inner margin broadly rounded, the outer margin 3–4-sided; stamens not seen. INFRUCTESCENCE with lavender, ellipsoid berries, prominently beaked, ca. 1 cm long, 6 mm diam., mesocarp with numerous, dense raphide cells in apical half; seeds 1–2, ellipsoid, 3.5 mm long, 2.2 mm diam., pale green, completely enveloped in a gelatinous, transparent envelope. Figs. 77, 78, and 79.

Anthurium foreroanum is known only from



FIGURES 77–80. 77–79. *Anthurium foreroanum* Croat, *Gentry et al. 16888*.—80. *Anthurium gentryi* Croat, *Gentry 3525*.

the Serranía del Darién along the border of Panama and Colombia at 1,400 to 1,750 m in a lower montane wet forest life zone.

It is a member of section *Calomystrium* and is named in honor of one of the collectors of the type, Sr. Luis Forero. The species is characterized by its ovate-cordate blades that dry matte and grayish green and have the collective vein arising from the first basal vein and then forming an acute angle with the margin and becoming rather remote from the margin near the middle of the blade. Other characteristic features include the white spathe, the reddish spadix, and the ovoid-ellipsoid, prominently beaked, lavender berries.

Anthurium foreroanum is probably most closely related to *A. fraternum* Schott from the Sierra Nevada de Santa Marta in northeastern Colombia near the Venezuelan border and may be only subspecifically distinct from the latter. The two species share similar leaves but the berries of *A. fraternum* are reddish purple to orange. The spathe of *A. foreroanum* is reportedly curled in fruit, whereas the spathe of *A. fraternum* is erect in fruit.

DARIÉN: vicinity Cerro Tacarcuna, *Gentry & Mori 14074* (MO), *Gentry et al. 16888* (COL, MO, PMA); Cerro Mali base camp, Colombian border, 1,400 m, *Gentry & Mori 13764* (MO).

Anthurium formosum Schott, Oesterr. Bot. Z. 8: 181. 1858. TYPE: Costa Rica. Cartago(?): near Naranjo, *Wendland 583* (GOET).

Anthurium lactiflorum Engl., Bot. Jahrb. Syst. 6: 277. 1885. TYPE: Colombia, *Lehmann 2582* (B).

Epiphytic or often terrestrial; stems often to 1 m long; cataphylls drying tan, persisting intact; petioles 40–150 cm long, 0.6–1 cm diam., subterete, weakly flattened or weakly sulcate adaxially; blades ovate, 30–80 cm long, 20–52 cm wide, deeply lobed at base. Inflorescence erect-spreading; peduncle 21–47 cm long, stout; spathe subcoriaceous, ovate or oblong-elliptic, pale greenish white to pale violet, 12.5–24 cm long, 3–8.5 cm wide; spadix stipitate 12–15 mm, white to violet purple, more or less oblong, tapered at both ends, 5.5–14.5 cm long, 1.2–1.5 cm diam. at middle; berries dark reddish violet to violet purple, often reddish orange at base, narrowly acute at apex, 10–12 mm long, 4–5 mm diam.; seeds 2. See Croat (1983: 297) for a more complete description.

The species is found in Costa Rica, Panama, Colombia, and perhaps also Ecuador [see *Gentry 9621* (MO)] at elevations of 500 to 1,500 m. In Costa Rica and Panama the species occurs in premontane wet forest and more commonly in premontane rain and lower montane rain forest. It is often one of the most common species at middle elevations where it is generally found along shady road banks and sometimes forms large stands.

The species is a member of section *Calomystrium* and is distinguished by its usually large cordate blade with a prominent posterior rib, its large ovate or oblong-elliptic, subcoriaceous spathe, and by its glossy tepals, sharp, early-emergent pistils, and reddish violet to violet purple berries. Leaf blades usually dry olive green with characteristic reddish brown veins and with purplish and/or brownish blotches.

BOCAS DEL TORO: ENE of Cerro Pata de Macho, *Hammel 6137* (MO).

CHIRIQUÍ: Cerro Colorado, *Croat 48445* (MO), *Folsom & Mauseth 8449* (MO); vicinity Fortuna Dam site, *Antonio 5023* (MO), *Croat 48659, 48746* (MO), *49847, 49892* (F, MO, SEL), *49995* (FTG, MO), *Hammel 2117, 2267* (MO); between Pinola & Quebrada Hondo, *Kirkbride & Duke 895* (MO); NW of confluence of Río Hornito & Río Chiriquí, *Stevens 18379A* (MO); vicinity San Félix, *Croat 33147* (MO, PMA), *Mori & Kallunki 5903* (MO).

COCLÉ: Cerro Pilón, *Dwyer & Lallathin 8675* (MO); vicinity El Copé, *Croat 44592* (MO), *Folsom 5817* (MO), *Folsom & Collins 1532* (MO), *Folsom & Button 3304* (MO); past Llano Grande on road to Cascajal, *Sytsma 3972* (MO), *Sytsma et al. 4421* (MO).

COLÓN: Río Guanche, *Hammel et al. 4911* (MO).

VERAGUAS: slopes of Cerro Tute, *Croat 48932, 48975* (MO), *Mori & Kallunki 5252, 6227* (MO); vicinity Escuela Agricola Alto Piedra, *Antonio 3955* (MO), *Croat 34149* (MO, PMA), *49014* (MO), *Sytsma & Andersson 4782* (MO); valley of Río Dos Bocas, *Croat 27525* (DUKE, F, K, MO, NY, SEL).

Anthurium fragrantissimum Croat, sp. nov. TYPE: Panama. Coclé: new works at Rivera sawmill, Alto Calvario, 600–800 m, *Folsom 3184* (MO 2603144, holotype; B, F, K, NY, PMA, SEL, US, VEN, isotypes; Live at MO).

Plerumque epiphytica; cataphyllum membranaceum, persistens in reticulum fibrarum, petiolus argute sulcatus, 3.5–19(–25) cm longus; lamina subcoriacea, oblanceolato-elliptica aut oblongo-elliptica, basi obtusa ad acuta, 28–44 cm longa, 5–10 cm lata, pagina inferiore glanduloso-punctata; inflorescentia effusa; pedunculus teres, 40–52 cm longus; spatha pallide viridis, oblanceolata, 6–10 cm longa, 1.5–2 cm lata; spadix pallide viridis, 10.3–12 cm longus, valde aromaticus; baccae rubrae, obovoidae ad obovoido-ellipsoideae, 6 mm longae.

Usually epiphytic; stems 7–10 cm long, ca. 4 cm diam.; roots moderately thin, descending; leaf scars and internodes obscured by persisting cataphylls; cataphylls thin, 4.5–6 cm long, rounded and apiculate at apex (the acumen to 5 mm), drying brown (B & K Yellow-red 3/10), persisting as reticulate fibers. LEAVES erect to spreading; petioles 3.5–19(–25) cm long, 6–8 mm diam., sharply sulcate, rounded abaxially; geniculum 0.8–1.3 cm long, shaped like petiole; blades subcoriaceous, usually oblanceolate-elliptic, sometimes oblong-elliptic, sometimes arched along midrib, acuminate at apex, obtuse to acute at base, 28–44 cm long, 5–10 cm wide; both surfaces semiglossy, upper surface eglandular, lower surface paler, densely glandular-punctate; midrib raised and broadly rounded above, narrowing and sunken at apex, convexly raised below; primary lateral veins 20–25 per side, departing midrib at ca. 35° angle, sunken, loop-connected from base; interprimary veins slightly sunken above, obscure below; collective vein sunken above, raised below, 2–8 mm from margin. INFLORESCENCE spreading, equal to or longer than leaves; peduncle 40–52 cm long, 3.5–4 mm diam., terete, green or purple (B & K Blue-purple 2/10), 3–4 times longer than petioles; spathe oblanceolate, pale green, 6–10 cm long, 1.5–2 cm wide, broadest at base, inserted at ca. 70° angle on peduncle, decurrent ca. 1.2 cm on peduncle; spadix pale green (B & K Yellow-green 7/5), 10.3–12 cm long, 6–8 mm diam. near the base, 3–4 mm diam. near the apex; flowers square, 2–2.3 mm in both directions, the sides jaggedly sigmoid, the principal spiral with 4–6(–10) flowers visible, 7–8 flowers visible in the alternate spiral; tepals matte, 1–1.4 mm wide, the inner margins straight, flat against pistil; pistils emergent, darker green than tepals; stigmas linear, with clear droplets apparent 1 month before stamens appear, drying brown before stamens emerge; strongly aromatic at this time and continuing for several days; stamens emerging rapidly in a regular sequence beginning at the base, each of the 4 stamens (beginning with one of the laterals) emerging throughout the spadix before the succeeding stamens (second lateral, anterior alternate, finally the posterior alternate) begin to emerge, held against sides of pistil; anthers bright yellow, 0.4–0.5 mm long, 0.5–0.6 mm wide; thecae ellipsoid, slightly divaricate; pollen golden yellow, fading to white. INFRUCTESCENCE pendent; berries red, obovoid to obovoid-ellipsoid, ca. 6 mm long, ca. 3 mm wide; pericarp thick, with raphide cells; mesocarp with numerous, large, raphide cells; seeds 1 or 2, ovoid-ellipsoid, tan, scarcely flattened, 2.7 mm long, 1.5 mm wide with blunt appendage just covering beak of seed. Figs. 81 and 82.

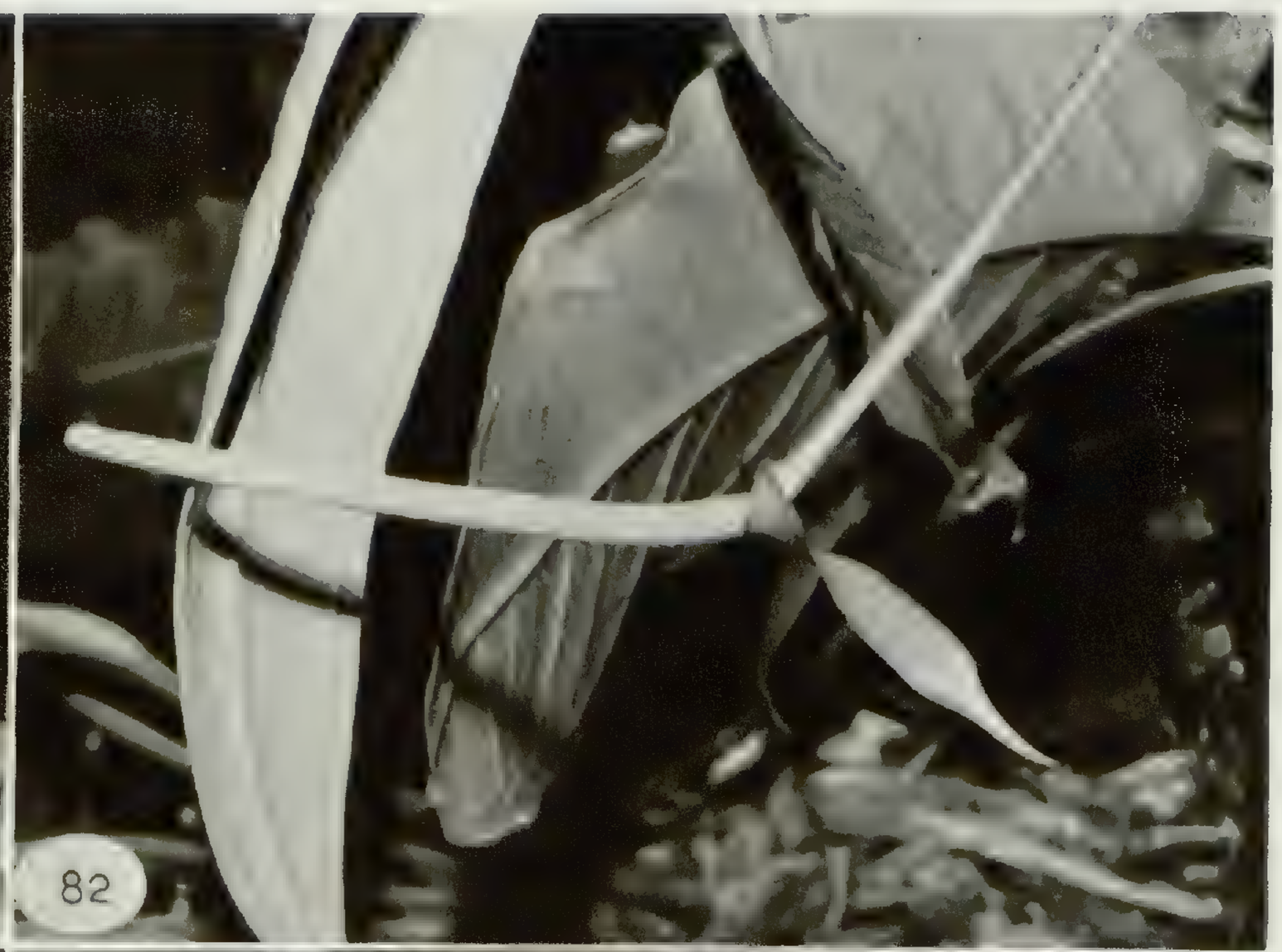
Anthurium fragrantissimum is known from Panama and Colombia in El Valle. It occurs from near sea level to 1,200 m (mostly above 300 m) in tropical wet and premontane rain forest life zones.

The species, a member of section *Porphyrochitonium,* is distinguished by its usually many-veined, oblanceolate to oblong-elliptic leaf blades that dry conspicuously blackened, its sharply sulcate petioles less than one-half as long as the blade, and by its elongate, scarcely tapered greenish to greenish white spadix that is markedly sweet scented during the middle part of the day. The species is also characterized by its red berries. It is not easily confused with any other species.

The name of the species refers to the strong, pleasant fragrance of the flowers at anthesis, which is unusual for members of section *Porphyrochitonium,* as most of the species of this group are not fragrant.

Anthurium fragrantissimum is repeatedly fragrant during midday for several weeks after the flowers have matured during both the pistillate phase and the staminate phase. The aroma is usually apparent by 11:00 A.M. (often as early as 9:00 A.M.), continues strong until about 2:00 P.M. and diminishes altogether usually by 4 or 5 A.M. The midday occurrence of aroma suggests that this species (and other cloud forest species as well that are known to have timely emission of aroma) has evolved an intermittent scent to attract insects only during that part of the day when the weather usually permits the flight of insects. It is well known that during much of the year cloud forest areas are characterized by extreme fog during part of the morning and by clouds and rain in late afternoon.

COCLÉ: Cerro Gaital Caracoral, *Dwyer & Correa 8894* (MO); between Continental Divide & El Petroso sawmill, *Sytsma et al. 2374* (MO); N of turnoff to Coclecito from Llano Grande, *Hammel 1823, 1847* (MO); N of El Valle de Antón, *Luteyn & Kennedy 1665* (DUKE, MO), *Wilbur & Luteyn 11735* (DUKE); beyond La Mesa towards Los Llanos & border of Coclé & Panamá Provinces, *Luteyn 3174* (DUKE); La Mesa, above El Valle de Antón, *Croat 37408* (MO), *Hammel 3837* (MO); road between La Pintada & Coclecito, *Croat 49219, 49237, 49248* (MO), *49233* (BH, FTG,



FIGURES 81–84. 81. *Anthurium fragrantissimum* Croat, *Croat 49237*.—82. *Anthurium fragrantissimum* Croat, *Folsom 3184*.—83, 84. *Anthurium garagaranum* Standl., *Croat 49788*.

MO); new works at Rivera sawmill, Alto Calvario, *Folsom 3184* (B, F, K, MO, NY, PMA, SEL, US, VEN); along Río San Juan above fork with Río Tife, *Hammel 3451* (MO).

COLÓN: S approach to Cerro Bruja, *Hammel 3198* (MO); Río Guanche, *Kennedy & Foster 2204* (MO).

DARIÉN: vicinity Tyler Kittredge mining camp, *Croat 27241* (MO, PMA).

PANAMÁ: Campo Tres, *Croat 22732, 27066* (MO); NE of Cerro Azul, *Mori & Kallunki 3303, 3385* (MO); vicinity Cerro Jefe, *Antonio 3223* (MO), *Antonio et al. 3414* (MO), *Sytsma et al. 2871* (MO); El Llano-Cartí Road, *Kennedy 2560* (MO), *Kennedy & Dressler 3492* (F), *Knapp 1360, 1362* (MO), *Nee 10480* (MO).

VERAGUAS: N of Santa Fe, *Hammel 4667* (MO); along Santa Fe to Calovébora Road, *Croat 49000, 49069* (FTG, MO); valley of Río Dos Bocas, *Croat 27389, 27446, 27611* (MO).

Anthurium friedrichsthalii Schott, Oesterr. Bot. Wochenbl. 5: 65. 1855. *Anthurium gracile* (Rudge) Lindl. var. *friedrichsthalii* (Schott) Engl., Bot. Jahrb. Syst. 25: 370. 1898. TYPE: Guatemala. Insula Cativo, *Friedrichsthal s.n.* (W, type destroyed; Photo of Schott Aroid Drawing #322, NYBG Neg. #N.S.3819).

Anthurium linearifolium Engl., Bot. Jahrb. Syst. 25: 370. 1898. TYPE: Panama. Canal Zone: Río Chagres, *Lehmann 4538* (B, K).

Epiphyte, usually pendent, often loosely attached by only a few roots; stem usually less than 15 cm long, 1–1.5 cm diam.; cataphylls weathering to coarse, linear fibers; petioles 1.5–14 cm long, mostly less than 10 cm long, ca. 2–3 mm diam., terete or flattened adaxially; blades linear, 12–56 cm long, 0.8–4 cm wide, subacute at base. Inflorescence pendent; peduncles 19–30 cm long, ca. 2.5 mm diam., terete; spathe linear, pale green, 1–5 cm long, 3–5 mm wide; spadix pale green, sometimes tinged purplish, turning purplish to brownish, 3–15 cm long, 4–5 mm diam.; berries pale yellow-orange, irregularly shaped, broader than long, ca. 5 mm long, 5–8 mm wide; seeds 3 or 4. See Croat (1983: 297) for a more complete description.

The species is found from Costa Rica (possibly Guatemala) to Colombia at elevations from sea level to usually 800 m. In Costa Rica and Panama it is common in tropical moist forest and is also known from premontane wet and tropical wet forest.

Anthurium friedrichsthalii is recognized by its pendent habit and thick, strap-shaped, bicolored, punctate leaves with the midrib prominently raised on both sides. Also distinctive are the long-pedunculate inflorescence, the thin, lanceolate, green spathe that promptly withers, the long, sessile, usually brownish to purplish spadix, and the orange berries that are broader than long, indented at the apex, and broader in the direction of the axis than perpendicular to the axis.

Engler (1905) placed this species in section *Leptanthurium* with *Anthurium gracile,* but it is a member of section *Porphyrochitonium* differing from the more typical members of that section only in its linear leaves and pendent habit. The species is closest to *A. brevispadix,* which differs in having a long-stipitate, stubby, pale greenish spadix with two to three flowers visible per spiral and stamens that remain exposed after anthesis.

The species has been confused with smaller plants of *Anthurium pendens,* but these collections can be distinguished by having slightly broader blades that usually dry blackened. In addition, *A. pendens* has anthers visible on drying while those of *A. friedrichsthalii* are strongly retracted.

Particularly noteworthy is *Mori & Kallunki 6392* with a peduncle less than 6 cm long and exposed stamens; it is also reported to have a white spathe that is otherwise not reported for *Anthurium friedrichsthalii.* It appears, however, not to be closely related to *Nee et al. 8758,* which has leaves typical for *A. friedrichsthalii* but has exserted stamens. Additional collections of these plants are necessary before any decision can be made of their status.

Anthurium friedrichsthalii is similar to *A. longistipitatum,* which has relatively long, strap-shaped leaves but that species has leaves with the midrib almost flat beneath and a long-stipitate spadix. Similarly narrow-leaved plants of *A. wendlingeri* could be confused with *A. friedrichsthalii,* but that species has the upper surface velvety (epidermal cells prominently raised on dried specimens) and has a generally much longer spadix that is white to grayish white at anthesis and soon coils like a corkscrew.

Noteworthy is the fact that though Schott ascribes the type of *Anthurium friedrichsthalii* to Guatemala not a single collection has been seen from that country. The specimen was perhaps erroneously labeled.

BOCAS DEL TORO: Río Cricamola between Finca St. Louis & Canquintú, *Woodson et al. 1883* (MO).

CANAL ZONE: Barro Colorado Island, *Chickering 61* (MICH), *Croat 4032A, 5483, 6614, 6845, 6980, 8019, 8080, 8893, 12003* (MO), *4624* (MO, PMA), *Ebinger*

63 (MO), *Foster 905, 1712* (DUKE), *Shattuck 200, 594* (MO), *Zetek 6015* (MO); Colón to Empire, *Crawford 557* (NY); Fort Sherman, *Liesner 1339* (MO); NW of Gamboa, *Nee 7220, 10433* (MO); Mohinga Swamp, *Bailey & Bailey 589* (BH); between Mt. Hope & Santa Rita Trail, *Cowell 57* (NY); Salamanca Hydrographic Station on Río Pequení, *Dodge et al. 16523A* (BR, MO, RS); Summit Gardens, *Croat 16557* (MO).

CHIRIQUÍ: San Bartolo Limit, W of Puerto Armuelles, *Liesner 191* (MO, NY).

COCLÉ: road to Coclecito, *Hammel 3507* (MO); between Continental Divide above El Copé & El Petroso sawmill, *Sytsma et al. 2396* (K, MO), *2593* (MO); La Mesa, above El Valle, *Croat 25375* (MO); above Penonomé, *Williams 606* (NY).

COLÓN: near Peluca on road to Nombre de Dios, *Kennedy 2650, 2782* (MO, NY); SW of Portobelo, *Liesner 1067* (MO); SE of Río Duque on Boyd-Roosevelt Hwy., *Croat 11042* (MO); Río Guanche, *Croat 14120* (MO), *36968* (CAS, K, MO, NY), *Sytsma 1624* (MO); along Río Iguanita, above bridge on Portobelo Road, *Croat 49758* (MO); Río Viejo between Portobelo Road & Quebrada Ruiz, NE of Puerto Pilón, *Nee 7172* (MO, RSA); Santa Rita Ridge, *Croat 14187* (MO), *Hammel 3650* (MO), *Kennedy 2768* (MO), *Lewis et al. 5403* (MO).

DARIÉN: no other location, *Sexton 104* (MO); vicinity El Real, *Duke 4832* (MO), *Kennedy 2823* (MO), *Stern et al. 776* (MO); near Estero Grande off Río Marea, *Duke 10963* (MO); vicinity Manené to Río Cuasí, *Hartman 12206* (MO), *Kirkbride & Bristan 1420* (MO); vicinity Pinogana, *Pittier 6525* (NY); road to Pirre, *Duke & Bristan 254* (DUKE, MO); Río Pirre, *Croat & Porter 15512* (MO).

PANAMÁ: Cerro Jefe, *Croat 35870* (MO); El Llano-Cartí Road, *Gentry 5569A* (MO), *Kennedy & Dressler 2956* (MO), *Luteyn 4117* (DUKE, MO); behind Peluca Meteorological Station, *Kennedy & Dressler 2964* (MO).

VERAGUAS: Cerro Tute, *Sytsma & Andersson 4588* (MO), *Croat 48952* (MO); road between Alto Piedra & Río Dos Bocas, *Croat 25964* (MO); W of Santa Fe, *Hammel 4600* (MO).

Anthurium fusiforme Croat, sp. nov. TYPE: Panama. Chiriquí: cloud forest along Continental Divide on Cerro Colorado on upper mining road, 20–28 mi. above San Félix, 1,200–1,500 m, *Croat 33332* (MO, holotype; PMA, US, isotypes; Live at MO).

Planta epiphytica, cataphyllum coriaceum, persistens intactum; petiolus subteres, 20–54(–70) cm longus; lamina ovata, coriacea, basi profunde cordata, 19–45.5 cm longa, 13–32 cm lata; inflorescentia erecta; pedunculus teres, 11–15 cm longus; spatha pallide viridis, coriacea, oblongo-ovata ad late ovata, 8–11.5 cm longa, 3–5.5 cm lata; spadix pallide viridis ad albus, 6–9 cm longus; baccae luteae, apice rotundae.

Epiphyte; stems more than 10 cm long, 3–4.5 cm diam.; leaf scars ca. 1.5 cm wide; roots ca. 5 mm diam., descending; cataphylls coriaceous, 9–16.5 cm long, apiculate at apex, drying dark brown (B & K Yellow 4/5), persisting intact. LEAVES erect to spreading; petioles subterete, 20–54(–70) cm long; geniculum 3–4.2 cm long; blade ovate, coriaceous, long-acuminate at apex, deeply lobed at base, 19–45.5 cm long, 13–32 cm wide, broadest between point of petiole attachment and midway; anterior lobe 14–34 cm long, the margins rounded to convex; posterior lobes 4.5–16.2 cm from apex of sinus to outermost point; sinus hippocrepiform to parabolic, rounded at apex; upper surface matte to semiglossy, lower surface semiglossy; midrib convexly to acutely raised above, diminishing and sunken toward apex, convexly raised at base below, more acute toward apex; basal veins 4–6 pairs, first to second, sometimes third, free to base, those remaining coalesced 0.5–3.5 cm, raised above and below; posterior rib naked, turned up on outermost margin; primary lateral veins 3–5 per side, departing midrib at 30–50° angle, sunken above, prominulous below, lesser veins scarcely visible, drying raised on both surfaces; collective vein arising from the first basal vein or one of the primary lateral veins in the apical one-third of blade, sunken above, raised below, 3–7 mm from margin. INFLORESCENCE erect, shorter than leaves; peduncle terete, 11–15 cm long, 5–7 mm diam., ca. one-third as long as petioles; spathe pale green (B & K Yellow-green 7/10), coriaceous, oblong-ovate to broadly ovate, 8–11.5 cm long, 3–5.5 cm wide, broadest near the base, caudate-acuminate at apex, obtuse, rounded to subcordate at base; spadix pale green to white, 6–9 cm long, 1–1.6 cm diam. midway, scarcely tapered at both ends; flowers 4-lobed, 2–3 mm long, 2.1–3.5 mm wide, sometimes equal in both directions, the sides jaggedly sigmoid, 12–22 flowers visible in the principal spiral, 7–15 visible in the alternate spiral; tepals matte to glossy, lateral tepals 1–1.6 mm wide, the inner margin broadly rounded; pistils scarcely emergent, white; stigmas linear, ca. 0.3 mm long; stamens emerging scattered throughout spadix, laterals first, exserted for some time before alternates emerge; anthers white, clustered around pistil, 0.4–0.6 mm long, 0.6–0.8 mm wide; thecae ovate-elliptic, slightly divaricate; pollen white. INFRUCTESCENCE with spathe persisting; spadix to 15 cm long, ca. 3 cm diam.; berries yellow, rounded at apex, mesocarp gelatinous; seeds 2, 3–3.5 mm long, 2–2.5 mm wide, 1.1–1.2 mm thick, flattened, enveloped in a gelatinous substance. Figs. 67 and 68.

Anthurium fusiforme is endemic to Panama and is known only from the Fortuna and Cerro Colorado regions in premontane forest life zones at 1,000 to 1,400 m.

The species, a member of section *Calomystrium,* is distinguished by its persistent, thick, intact cataphylls, its thick ovate blades with the collective vein arising from the uppermost basal vein or one of the primary lateral veins, and especially by its pale green, fusiform spadix, which is unlike that of any other known species of *Anthurium.*

Vegetatively the species could be confused with *Anthurium hoffmannii* or *A. formosum,* but both of the latter have the collective vein usually close to the margin, whereas the collective vein of *A. fusiforme* is more distant from the margin.

CHIRIQUÍ: between Boquete & Cerro Horqueta, *Duke A13711* (MO); Cerro Colorado, *Croat 33332* (MO, PMA, US); Fortuna Dam site, *Croat 48707, 48741, 48757* (MO), *Hammel 2001* (MO), *Sytsma & Stevens 2266* (MO); along road between Gualaca & Fortuna Dam site, *Croat 49903, 49944, 50058* (MO).

Anthurium garagaranum Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 68. 1940. TYPE: Panama. Darién: foothills of Garagará, 30–500 m, Feb. 1912, *Pittier 5601* (US, holotype; MO 1292151, photo).

Epiphytic creeper; stem green, smooth, to 2 cm diam., leaf scars obscured by roots and persisting cataphyll fibers; cataphylls 6–8 cm long, drying brown, weathering to longitudinal fibers, remaining intact at apex, persisting. LEAVES with petioles spreading, (12–)20–77 cm long, 0.8–1 cm diam., subterete; geniculum 1.2–1.7 cm long, weakly sulcate; blades subcoriaceous, juvenile blades oblong, adult blade 3-lobed, median lobe acuminate at apex, (22–)31–67 cm long, 8.5–18 cm wide, usually broadest above middle, lateral lobes 14–39 cm long, 9–29 cm wide, usually at right angle to median lobe, sometimes weakly falcate; upper surface matte, lower surface semiglossy, much paler; midrib acutely raised and paler than surface above, diminishing and sunken toward apex, convexly raised below; basal veins 4–6 pairs, the first sometimes free, usually all veins coalesced (1.5–)5.5–10 cm, forming thick upturned posterior rib, raised above and paler than surface, raised below; primary lateral veins 6–9 per side, departing the midrib at 40–60° angle (sometimes at a 25–30° angle in juvenile blades), straight to collective vein, raised near midrib, sunken near collective vein, raised below; lesser veins scarcely visible; collective vein of the median lobe arising from one of the primary lateral veins in the apical half of the blade (sometimes from a primary lateral vein in the basal half of the blade, rarely from the first basal vein in juvenile blades); sunken above, raised below, usually scarcely removed from the margin. INFLORESCENCE erect-spreading, shorter than petiole; spathe pale green, subcoriaceous, lanceolate, 11–34 cm long, 1.8–2.3 cm wide, broadest near middle or just below, long-acuminate at apex, acute at base, usually strongly reflexed; spadix stipitate to 1 cm, bright golden yellow, (12–)23–47.5 cm long, 0.6–1.6 cm diam. at base, 3–6 mm diam. near apex; flowers rhombic to 4-lobed, 2–2.4 mm long, 1.2–1.5 mm wide, the sides straight to weakly sigmoid; 12–15 flowers visible in the principal spiral, 15 or more flowers visible in the alternate spiral; tepals glossy 0.5–0.7 mm wide, the inner margin convex; pistils scarcely emergent; stigmas elliptic, 0.5 mm long, brush-like; stamens not emerging, pollen gold, oozing from between pistil and tepals in ribbons and held around edges of tepals; anthers and thecae not visible. INFRUCTESCENCE with purple to dark violet purple oblong-elliptic berries, white at base, purplish at apex or purple; seeds 2, oblong-elliptic, brownish, 2.8–4 mm long, 1.5–2 mm wide, 1.1–1.3 mm thick enveloped in a sticky mucilaginous substance. Figs. 83 and 84.

Anthurium garagaranum ranges from Central Panama to Colombia (Departments of Chocó and Valle) at elevations ranging usually from near sea level to 900 m, but rarely to 1,400 m, usually occurring in tropical wet or premontane forest life zones, rarely in lower montane wet forest.

The species is in section *Semaeophyllium* and is distinguished by its three-lobed leaf blades, its long-tapered, yellow to orange-yellow (at anthesis) spadix, its large linear-lanceolate spathe, and by its purple to purple and white (at base) berries. One collection (*Gentry et al. 16853*) reports the fruit to be white. At anthesis the spadix is sweetly aromatic and has been observed being visited by the euglossine bee *Eulaema polychroma* (*Kennedy & Dressler 2983*).

The single collection seen from Valle Department in Colombia (*Cuatrecasas 16457*) has a much stouter spadix and lacks the stout naked posterior rib associated with Panamanian material but otherwise appears to be this species. A

specimen with an immature spadix (*Daniel 2584*) from Antioquia appears also to be this species.

Anthurium garagaranum was included with *A. trilobum* Linden ex André by Madison (1978), but material attributed to that species is *A. cineraceum, A. furcatum* Sodiro, or *A. falcatum* Sodiro, and *A. trilobum* is now considered a synonym of *A. signatum* C. Koch & Mathieu of western Venezuela. *Anthurium insigne* Mast., a species from western Colombia, is similar to *A. garagaranum* in having bright yellow spadices at anthesis (never orange or reddish as reported by Madison, 1978) but differs in having shorter spadices that dry brownish and matte, not glossy and blackened as in *A. garagaranum.* In addition *A. insigne* has fewer flowers per spiral (seven to eight) and stamens exserted with the intact thecae exposed on dried specimens. *Anthurium garagaranum,* on the other hand, has stamens that are never exposed (see description above).

Anthurium garagaranum may also be confused with *A. cineraceum* where the two species occur together in far western Panama and in Colombia in Chocó Department. The latter species differs in having spadices with fewer flowers per spiral (seven to 12), spadices that dry matte and frequently reddish brown rather than semiglossy and blackened, and leaf blades that dry typically grayish rather than greenish brown to dark brown as in *A. garagaranum.*

Anthurium garagaranum is perhaps most closely related to *A. subsignatum* Schott and may ultimately prove to be merely a subspecies of that species. The latter differs in being generally a more scandent species and by having generally smaller leaves that are more shallowly lobed.

Panamanian material of *Anthurium garagaranum* typically has shorter, more rounded lateral lobes, whereas material collected in the Chocó Department of Colombia has lateral leaflets more elongate and pointed at the apex.

COCLÉ: New Works, Alto Calvario, N of El Copé, *Folsom 2480* (MO); toward Alto Calvario from La Junta, *Folsom 5908* (MO); NE slopes of Cerro Caracoral, *Sytsma 4083* (MO); vicinity Cerro Pilón, *Croat 37567* (MO), *Porter et al. 4375* (MO); El Valle de Antón, near Cerro Turega, *Woodson & Schery 167* (MO); La Mesa, *Croat 14397, 37340* (MO); near Continental Divide, above El Copé, *Hammel 955, 1049* (MO), *Knapp & Dressler 3488* (MO); road between Llano Grande & Coclecito, *Croat 49222* (MO); past Llano Grande on road to Cascajal, *Sytsma 3844* (MO); Cerro Gaital, N of El Valle, *Knapp 5800* (MO).

COLÓN: between Río Piedras & Río Gatún, SW of Cerro Bruja, *Sytsma et al. 4296* (MO, PMA); between Portobelo & Río Cascajal, *Croat 33658* (MO); SW of Portobelo, *Liesner 1032* (MO); between Portobelo & Nombre de Dios, *Croat 33529* (MO, PMA), *49788* (F, MO, US), *Knapp 5686* (MO); Río Guanche, *Antonio 4810* (MO), *Croat 37021* (MO); Santa Rita Ridge Road, *Mori & Kallunki 5058* (MO), *Correa 587* (MO), *Croat 34304* (MO), *Knapp 5209* (MO).

DARIÉN: SW ridge to Alturas de Nique, *Hartman 12361* (MO, PMA); slopes of Cerro Pirre, *Gentry & Clewell 7124* (MO); foothills of Garagará, *Pittier 5601* [MO (Photo), US].

PANAMÁ: N of Cerro Azul, *Croat 11594* (MO); Cerro Campana, *Croat 12161, 35942* (MO); El Llano-Cartí Road, *Croat 14229, 25147* (MO), *Folsom & Collins 1519* (MO), *Folsom 2564* (MO), *Liesner 1192* (MO, NY); behind Peluca Meteorological Station, *Kennedy & Dressler 2983* (MO); vicinity Rancho Chorro Mts. above Tortí Arriba, *Folsom et al. 6678* (MO).

SAN BLAS: Aila Tiwar, *Sugden 455* (MO).

VERAGUAS: past Escuela Agricola Alto Piedra, on road from Santa Fe, *Folsom & Collins 1614* (MO); vicinity Escuela Agricola Alto Piedra, near Santa Fe, *Croat 48892* (MO); on road to Río Calovébora, *Croat & Folsom 33969* (MO), *Croat 49010* (MO); road between Escuela Agricola Alto Piedra & Río Dos Bocas, *Croat 25966* (MO); slope above Río Primero Brazo, *Liesner 819* (MO).

Anthurium gentryi Croat, sp. nov. TYPE: Panama. Panamá: Cerro Jefe to 1 mi. beyond summit, ca. 100 m, *Gentry 3525* (MO 2672710, holotype).

Planta epiphytica; cataphyllum coriaceum praecox deciduum; petiolus 3–6 cm longus, sulcatus; lamina siccitate modice coriacea, anguste ovata ad ovata-lanceolata, basi acuta, 5.5–10 cm longa, 1.6–2.7 cm lata, pagina inferiore conspicue glanduloso-punctata; inflorescentia foliis breviora; pedunculus 7–8 cm longus; spatha membranacea, viridis, oblongo-linearis, 2.7 cm longa, 3 mm lata; spadix viridis, anguste oblongus, 3.5–4.5 cm longus, baccae ignotae.

Epiphyte; stems less than 10 cm long, less than 1 cm diam.; internodes short; roots numerous, green, descending, 2–3 mm diam.; cataphylls thin, drying reddish brown, early deciduous. LEAVES erect; petioles 3–6 cm long, 2–3 mm diam., sulcate adaxially, rounded abaxially; geniculum 3–4 mm long; blades narrowly ovate to ovate-lanceolate, drying moderately thick, narrowly acute to acuminate at the apex, acute at base, 5.5–10 cm long, 1.6–2.7 cm wide, broadest at or below the middle; both surfaces semiglossy, upper surface minutely brownish speckled with short, linear, pale raphide cells, lower surface conspicuously glandular-punctate; midrib raised on both surfaces; primary lateral veins 5–7 per side, moderately obscure above, weakly raised below on drying; interprimary veins weakly raised; collective vein arising from the base, 2–3 mm from the margin, scarcely visible above, weakly raised

below. INFLORESCENCE shorter than the leaves; peduncle slender, 7–8 cm long, ca. 1 mm diam. (dried); spathe thin, green, oblong-linear, 2.7 cm long, 3 mm wide, narrowly acuminate at apex, inserted at 45° angle on peduncle; spadix green, narrowly oblong, 3.5–4.5 cm long, 2 mm diam. near the base, less than 1 mm diam. near apex; flowers (dry) rhombic, 2–2.2 mm long, ca. 1.5 mm wide, the sides moderately straight, 2–3 flowers visible in the principal spiral, 4–5 flowers visible in the alternate spiral; tepals semiglossy, lateral tepals 1.2–1.3 mm wide, the inner margin moderately straight, the space between the tepals elongated slightly in the direction of the axis, 0.7–0.9 mm long; pistil not emergent; stamens persistent after anthesis; anthers ca. 0.2 mm long; 0.4–0.6 mm wide, held at the level of the tepals around the pistil; thecae subcircular to broadly elliptic, divergent at ca. 180° angle from one another. INFRUCTESCENCE not seen. Fig. 80.

Anthurium gentryi is known only from the type collected in Panamá Province near the top of Cerro Jefe in premontane rain forest at about 100 m.

The species is a member of section *Porphyrochitonium* and is distinguished by its small size, its narrowly ovate to ovate-lanceolate blades that are eglandular with pale raphide cells visible on the upper surface and glandular-punctate on the lower surface, and especially by its very slender, green spathe and spadix with anthers that remain exserted.

Relatively few members of this section retain their stamens above the tepals after anthesis (especially after being dried) and none that do, such as *Anthurium terryae,* are in the least confused with *A. gentryi.*

The species is named in honor of Dr. Alwyn H. Gentry of the Missouri Botanical Garden who collected the type specimen.

PANAMÁ: near top of Cerro Jefe, *Gentry 3525* (MO).

Anthurium globosum Croat, sp. nov. TYPE: Panama. Chiriquí: Palo Alto, 4.5 mi. NE of Boquete, in forest along trail towards Cerro La Trompeta, *Hammel 7445* (MO 2904975, holotype).

Planta epiphytica aut terrestris; caudex usque 25 cm longus; cataphyllum coriaceum, persistens intactum; petiolus teres, (17–)25.5–62 cm longus; lamina modice coriacea, ovata ad ovato-triangulata, basi profunde cordata, 21–36 cm longa, 11.5–20 cm lata; inflorescentia plus minusve erectus, foliis breviora; pedunculus 4–30 cm longus; spatha subcoriacea, viridis, ovato-elliptica, 3–5 cm longa, 1.5–4.5 cm lata; spadix albus rubro-violescens, cylindricus ad globosus, 2–5.3 cm longus; baccae aurantiacae ad rubro aurantiacae, oblongo-ellipsoideae.

Epiphytic or terrestrial; stems to 25 cm long, 1–2 cm diam.; leaf scars obscured by persisting cataphylls; roots long, thin; cataphylls coriaceous, 12–20 cm long; drying reddish brown (B & K Yellow-red 4/7.5), persisting intact. LEAVES erect to erect-spreading; petioles (17–)25–62 cm long, ca. 4 mm diam., terete; geniculum 2–2.5 cm long; blades ovate to ovate triangular, moderately thick, long-acuminate at apex, deeply lobed at base, 21–36 cm long, 11.5–20 cm wide, broadest at point of petiole attachment or just above; anterior lobe 13.5–27 cm long, the margins rounded; posterior lobes 6–11.5 cm long, from apex of sinus to outermost point; the sinus hippocrepiform, rounded at apex; upper surface semiglossy with conspicuous raphide cells, lower surface drying matte; midrib raised above and below; basal veins 4–5 pairs, the first, sometimes second free to the base, the second to fifth coalesced 0.6–4.5 cm, raised above, prominently raised below; posterior rib naked, the inner margin weakly turned up; primary lateral veins 3–5 per side, departing the midrib at a 45–60° angle, sunken above, raised below, drying scarcely more conspicuous than lesser veins on upper surface, more prominent below, lesser veins visible on drying; collective arising from the first or second basal vein or sometimes from the third, 5–8 mm from margin, sunken above, raised below. INFLORESCENCE more or less erect, much shorter than leaves, peduncle 4–30 cm long, 4–6 mm diam., one-fifth to two-thirds as long as petioles; spathe subcoriaceous, green, ovate-elliptic, 3–5 cm long, 1.5–4.5 cm wide, broadest near the middle, rounded at apex, rounded to more or less obtuse at base, held erect at anthesis; stipe to 4 mm long; spadix white, becoming red-violet, short, cylindroid (scarcely tapered) to globose, 2–5.3 cm long, 7.5–20 mm diam. midway, flowers 4-lobed, ca. 1.5 mm long, 2.5 mm wide, the sides straight to weakly sigmoid; ca. 8 flowers visible in the principal spiral, ca. 12 flowers visible in the alternate spiral; tepals glossy, the lateral tepals ca. 0.6 mm wide, the inner margin rounded, the outer margin 3–4-sided; pistils raised, emergent; stamens held over and obscuring pistil; anthers white, 0.8 mm wide (dry). INFRUCTESCENCE erect-spreading; spathe

reflexed; spadix 4–6 cm long, ca. 3.5 cm diam.; berries orange to red-orange, oblong-elliptic, 1.3–1.5 cm long, 5–5.5 mm diam., mesocarp white, gelatinous, with raphide cells; seeds 1–2, pale green to yellow, 4.3–4.5 mm long, 2.3–2.8 mm wide, appendaged at apex, surounded by a clear mucilaginous sac. Figs. 156, 158, and 159.

Anthurium globosum is known only from western Panama in Bocas del Toro and Chiriquí Provinces at 1,700 to 2,300 m in lower montane rain forest and has only been found near Boquete.

The species is in section *Calomystrium* and is recognized by its ovate to ovate-triangular blades, its short pedunculate inflorescence, its cylindroid, scarcely tapered, often globose spadix, and by its erect, broadly ovate spathe.

Although *Anthurium globosum* is quite distinctive and not easily confused with any other species, the spadix may vary from white to red-violet (apparently becoming red-violet as it matures). There also seems to be a variation in the coloration of the leaves on drying with a few specimens (e.g., *Mori & Bolten 7480* and *Kirkbride & Duke 936*) drying rather gray while the others dry brown to reddish brown.

BOCAS DEL TORO: NW ridge of Cerro Pata de Macho, *Sytsma et al. 4966* (MO).

CHIRIQUÍ: Boquete region, *Hagen 2159, 2177* (NY); Cerro Hornito, *Folsom et al. 7215* (MO, PMA), *Mori & Bolten 7480* (MO); Cerro Horqueta, *Cochran et al. 6279* (MO, WIS), *Hammel et al. 6540* (MO), *Luteyn 3773* (DUKE), *Maas & Dressler 4970* (MO); Palo Alto, NE of Boquete, *Hammel 7445* (MO); between Quebrada Hondo & Continental Divide on Caldera-Chiriquicito Trail, *Kirkbride & Duke 936* (MO, NY).

Anthurium gracile (Rudge) Lindl., Edward's Bot. Reg. 19: t. 1635. 1833. *Pothos gracilis* Rudge, Pl. Guian. Rar. 23: t. 32. 1805. TYPE: French Guiana, *Martin s.n.* (Herb. Rudge, BM).

Anthurium scolopendrinum (W. Ham.) Kunth, Enum. Pl. 3: 68. 1841. *Pothos scolopendrinus* W. Ham. Prodr. Pl. Ind. Occid. 16. 1825. TYPE: French Guiana, *Desvaux s.n.* (P).

Anthurium longipes Matuda, Soc. Bot. Mexico Bol. 14: 23. 1952 non N. E. Brown, 1882. TYPE: Belize, *Gentle 2624A* (MICH).

Epiphyte, usually erect; stems 1.5–30 cm long, 7–10 mm diam.; cataphylls drying reddish or brown, persisting intact, ultimately deciduous; petioles 1–20 cm long, ca. 3 mm diam., subterete, flattened adaxially; blades moderately thin, oblanceolate, 11–32 cm long, 3–8.5 cm wide, gradually tapered to long-cuneate at base. Inflorescence more or less erect; peduncles 13–40 cm long, 1–3 mm diam., spathe membranous, red-violet, lanceolate to oblong-elliptic or ovate-elliptic, 1.3–2.5 cm long, 3–7 mm wide; spadix sessile, purplish brown, 0.6–6 cm long, 2–4 mm diam. midway; berries bright red, more or less globose, slightly longer than broad, 6–8 mm long; seeds 2. See Croat (1983: 299) for a more complete description.

The species is found from Guatemala and Belize to the Guianas, southern Brazil and Peru. It is also known in the West Indies from Trinidad and Hispañola. In Costa Rica and Panama, the species is known only from tropical moist forest.

Anthurium gracile is in section *Leptanthurium* and is distinguished by its thin, oblanceolate, epunctate leaves, its persistent, intact cataphylls, its relatively few-flowered spadix, its whitish roots, and by its bright red, globose berries.

BOCAS DEL TORO: vicinity Almirante, *Kennedy 1270, 1287* (DUKE); Changuinola, *Croat & Porter 16308, 16343* (MO); vicinity Chiriquí Lagoon, *Wedel 1268, 1373, 2532* (MO); Water Valley, *Wedel 647* (MO).

CANAL ZONE: Barro Colorado Island, *Bailey & Bailey 406* (BH), *Bartlett & Lasser 16615* (MICH), *Busey & Croat 238* (MO), *Chickering 45* (MICH), *Croat 5392, 6743, 7957A, 9522* (MO), *Foster 1713* (DUKE), *Shattuck 626* (MO), *Starry 316* (MO); NW of Summit Gardens, *Nee 6915* (MO).

DARIÉN: 110 mi. from Bayano Dam bridge, *Antonio 4570* (MO); trail from Punta Guayabo Grande to Río Jaqué, *Antonio & Hahn 4433* (MO); hill near Río Chucunaque, below Yaviza, *Duke 4872* (MO); Río Pirre near trail from El Real to Tucutí, *Duke 5206* (MO).

PANAMÁ: Villa Rosario, *Soldaña 9* (MO).

Anthurium gracililaminum Croat, sp. nov. TYPE: Panama. Chiriquí: Fortuna Dam site, top of mountain S of camp, 8°41′N, 82°21′W, 1,700 m, *Folsom et al. 5430* (MO 2623576, holotype).

Planta epiphytica; cataphyllum findens in fibris tenuibus; petiolus subteres, camplanatus ad leviter sulcatus; lamina modice coriacea, oblongo-lanceolata, basi acuta, 16–26 cm longa, 3.5–5 cm lata, pagina superiore interdum inconspicue glanduloso-punctata, pagina inferiore conspicue glanduloso-punctata; inflorescentia erecta; pedunculus 13–31 cm longus; spatha membranacea, e viridis alba, oblongo-lanceolata, ca. 2.5 cm longa, 5 mm lata; spadix viridis, 2.5–3 cm longus; baccae, subglobosae, erubescens albae, 3–4 mm longae.

Epiphyte; stems short; leaf scars hidden by cataphylls; roots few, slender; cataphylls ca. 3 cm long, drying reddish brown, splitting into slender fragments with a few slender fibers exposed. LEAVES with petioles 12–25(–36) cm long, 2–3 mm diam., subterete, flattened to

weakly sulcate; geniculum ca. 1 cm long; blades moderately thick, oblong-lanceolate, gradually acuminate at apex (the acumen flat), acute at base, 16–26 cm long, 3.5–5(–6.7) cm wide, broadest in lower third of blade; upper surface semiglossy, eglandular or inconspicuously and sparsely glandular-punctate; lower surface slightly paler, dark glandular-punctate; midrib raised above, diminished and flat at apex, raised below; primary lateral veins 6–8(–10) per side, departing midrib at 50–60° angle, slightly curved to the collective vein, weakly sunken above, weakly raised below, weakly loop-connected; interprimary veins drying more or less as prominent as the primary lateral veins on both surfaces; collective vein arising from the base, 2–4 mm from the margin, weakly sunken above, weakly raised below. INFLORESCENCE usually erect, shorter than leaves; peduncle 13–31 cm long, 1–2 mm diam., equalling or to 2 times longer than petioles; spathe thin, greenish white, oblong-lanceolate, 2.2–4.5 cm long, 5 mm wide, broadest somewhat above the base, acuminate at apex, inserted at 60° angle on peduncle; spadix green, 2.5–3 cm long, 2.5–3 mm diam. near base, slightly tapered to apex; flowers square to 4-lobed, 4.5–5 mm in both directions, the sides jaggedly sigmoid, 3–4 flowers visible in the principal spiral, 5–6 flowers visible in the alternate spiral; tepals semiglossy, drying with conspicuous granular raphide cells; lateral tepals 1.8–2 mm wide, the inner margin broadly rounded; pistils not emergent; stigmas prominently raised, elliptic, 0.5 mm long, 0.3 mm wide; stamens apparently retracting after anthesis. INFRUCTESCENCE erect, spadix reddish, ca. 6 cm long, ca. 1 cm diam.; berries subglobose, white to pinkish white, rounded at apex, 3–4 mm long; seeds 2, broadly ellipsoid, brown, 2.1–2.7 mm long, 1.5–1.8 mm wide, 1.1–1.2 mm thick. Fig. 76.

Anthurium gracililaminum is endemic to Panama and all specimens included here were collected on the Fortuna Dam Road at 1,200 to 1,700 m in premontane rain forest.

The species is a member of section *Porphyrochitonium* and is distinguished by its oblong-lanceolate leaf blades that are glandular-punctate below and eglandular or sometimes inconspicuously, sparsely glandular-punctate above, its petioles half to almost as long as the blades, and especially by its short, stubby, green spadix that turns reddish in fruit and produces pinkish white berries.

A number of sterile collections (vouchers for living collections) that have dried yellowish green rather than brown are probably also this species (*Croat 48788, 48790, 48791, 49929, 50026*). Another collection (*Folsom 8176*) also has leaves drying greenish rather than brown.

The species may be confused with *Anthurium dichrophyllum* from Veraguas. See that species for differences.

CHIRIQUÍ: Fortuna Dam site, *Croat 48788, 48790, 48791* (MO), *Folsom et al. 5428, 5430, 8176* (MO); road between Gualaca & Fortuna Dam site, *Croat 49074, 49929, 50076* (MO).

Anthurium gracilispadix Croat, sp. nov. TYPE: Panama. Chiriquí: Cerro Colorado 1,500 m, *Antonio 1516* (MO 2782431, holotype; PMA, isotype).

Planta plerumque epiphytica, raro terrestris; cataphyllum findens in fibris tenuibus; petiolus 4–14 cm longus, adaxiale camplanatus; lamina membranacea, oblongo-elliptica ad lanceolato-elliptica, basi anguste acute ad attenuata, (8–)11–18 cm longa, 3–5.5 cm lata, utrinque glanduloso-punctata; inflorescentia et folia aequilongae; pedunculus 10–20 cm longus, teres ad leviter tri-costatus; spatha modice membranacea, viridis interdum suffusa rubra, lanceolata; spadix viridis, 5–9.5 cm longus; baccae pallide viridis, subglobosae, ca. 6 mm diam.

Plants usually epiphytic, rarely terrestrial; stems less than 5 cm long, less than 1 cm diam.; internodes short; leaf scars hidden by cataphylls; roots numerous, slender, spreading or directed downward; cataphylls 2.5–3 cm long, promptly weathering to slender, reddish brown fibers. LEAVES semierect; petioles 4–14 cm long, one-half to three-fourths as long as the blades, flattened adaxially with erect margins, rounded abaxially; geniculum to 1 cm long; blades thin, oblong-elliptic to lanceolate-elliptic, gradually sharp-acuminate at apex, narrowly acute to attenuate at base, (8–)11–18 cm long, 3–5.5 cm wide, broadest usually near the middle, drying thin, grayish green; both surfaces matte to semiglossy, glandular-punctate; midrib acutely raised above, weakly, convexly raised below; primary lateral veins 4–9 per side, departing midrib at ca. 45° angle, etched in surface above, prominulous below, directed straight to collective vein, weakly loop-connected, scarcely raised on both surfaces on drying; interprimary veins present, drying only slightly less conspicuous than the primary lateral veins. INFLORESCENCE usually about as long as the leaves, rarely slightly longer; peduncle 10–20 cm long, ca. 2 mm diam., equalling or to twice

as long as petioles, terete to weakly 3-ribbed; spathe moderately thin, green, sometimes tinged with red, spreading, lanceolate, 2.5–5 cm long, 4–8 mm wide, broadest below the middle, acuminate at apex, inserted at 45° angle on peduncle; spadix sessile or nearly so, green, 5–9.5 cm long, to 2 mm diam. at base, ca. 1 mm diam. near apex; the flowers (dried) rhombic, 3–4.2 mm long, 1.8–3 mm wide, 2–3 flowers visible in principal spiral, 3–4 visible in alternate spiral; tepals semiglossy, coarsely granular-punctate, the lateral tepals 2.7–3.5 mm wide, the inner margin straight to weakly concave, the space between the tepals 2.5–3.5 mm long, elongated in the direction of the axis; pistil not emergent; stigma linear; stamens not exposed on dried specimens, presumably emerging briefly, then retracting beneath the tepals. INFRUCTESCENCE with pale green, subglobose berries, ca. 6 mm diam. Fig. 99.

Anthurium gracilispadix is endemic to western Panama at 800 to 1,500 m in premontane rain and lower montane rain forest. Most collections have been made from Cerro Colorado but a collection from the Fortuna Dam Road (*Croat 49999*) and one from Santa Fe (Veraguas) (*Folsom 2973*) are perhaps also this species.

The species is a member of section *Porphyrochitonium* and is characterized by its thin, oblong-elliptic top lanceolate-elliptic, glandular-punctate (both surfaces) blades that are gradually sharp-acuminate at the apex, narrowly acute to attenuate at the base and dry gray-green with inconspicuous veins. Also characteristic is the narrow, sharply tapered, green spadix.

Due to similar blade shapes it can be confused with the smallest specimens of *A. lancifolium,* but that species has a relatively short, stubby, whitish or grayish white spadix. *Anthurium gracilispadix* is perhaps most similar to *A. oxystachyum,* which has leaves of similar size and a similar, sharply tapered green spadix. The latter species differs, however, in having leaf blades eglandular on the upper surface and obtuse to subrounded at the base.

Although tentatively placed in *Anthurium gracilispadix, Hammel 2302* differs in having proportionately longer blades that dry brown rather than gray-green and in having a proportionately longer spadix with thicker tepals.

BOCAS DEL TORO/CHIRIQUÍ: Cerro Colorado, *Folsom 6118* (K, MO, PMA).

CHIRIQUÍ: Cerro Colorado, *Antonio 1516* (MO, PMA), *Croat 33258* (MO), *Folsom & Collins 1734* (MO), *Mori & Dressler 7854* (MO, US); Fortuna Dam site, *Hammel 2302* (MO); road between Gualaca & Fortuna Dam site, *Croat 49999* (MO); slope NW of confluence of Río Hornito & Río Chiriquí, *Stevens 18374* (MO).

COCLÉ: Alto Calvario, *Croat 49200* (MO).

Anthurium hacumense Engl., Bot. Jahrb. Syst. 25: 363. 1898. TYPE: Costa Rica. Puntarenas: along banks of Río Hacum (Platanar) near Buenos Aires, 250 m, *Tonduz 6536* (B, holotype; BR, CR, isotypes).

Rosulate epiphyte; stem short; cataphylls drying dark brown, weathering to coarse linear fibers; petioles sulcate, rounded to weakly angular abaxially, 2–12 cm long, 1–1.5 cm diam.; blades narrowly to broadly oblanceolate, coriaceous, 25–81 cm long, 7.5–29 cm wide. Inflorescence erect-spreading; peduncle 10–27 cm long, subterete; spathe subcoriaceous, yellow-green tinged with violet purple, oblong-elliptic, 5.5–11 cm long, 2.2–3.5 cm wide; stipe becoming elongate to 29 cm at anthesis; spadix violet purple, 10–20 cm long, 1–2.5 cm diam. at base; berries bright red, narrowly obovoid, acute to mamilliform at apex, ca. 1 cm long; seeds 2. See Croat (1983: 300) for a more complete description.

The species is found in Costa Rica, Panama, and probably in Colombia in the Department of Chocó. It ranges from sea level to 1,560 m and occurs principally in tropical wet forest but also in premontane wet forest. Though the species is restricted to the Pacific slope in Costa Rica, it is known in Panama only from the Atlantic slope and along the Continental Divide on the Pacific slope.

Anthurium hacumense is in section *Porphyrochitonium* and can easily be distinguished in flower or fruit by its exceptionally long stipe, its dark violet purple tepals, and its bright red berries. Vegetatively the species can be recognized by its oblanceolate leaves with black punctations on the lower leaf surface and a conspicuous collective vein, which is quite remote from the margin.

CANAL ZONE: Madden Lake Cave Area, *Tyson & Lazor 6265* (MO); Río Azote Caballo, *Dodge et al. 16866* (MICH, MO); Río Indio, *Dodge & Allen 17297* (MO); Río Providencia, *Gentry & Nee 8711* (MO); Summit Garden, *Croat 12524, 16553* (MO).

CHIRIQUÍ: W of Puerto Armuelles, vicinity San Bartolo Limite, *Liesner 76* (MO).

COCLÉ: N of Cerro Pilón, *Liesner 717* (MO); Coclecito Road, *Hammel 2543* (MO); NW of El Copé, *Hammel 3327* (MO); El Valle behind Club Campestre, *Croat 14291A* (MO), *14293* (MO, PMA); La Mesa, above El Valle de Antón, *Croat 37374* (MO); road to Llano Grande & Coclecito, *Croat 49225* (MO); N of Penonomé, *Hammel 4012* (MO).

COLÓN: near Guásimo along river, *Croat 9962* (MO); near Peluca, *Kennedy 2772* (MO); upper Piedras headwaters, SW of Cerro Bruja, *Sytsma et al. 4241* (MO); 1 mi. from Portobelo, *Correa et al. 1754* (MO); end of Río Boquerón Road, *Hammel 2446* (MO); Santa Rita Ridge Road, *Knapp & Schmalzel 1795* (MO), *Sytsma 1572* (MO).

DARIÉN: Camp Summit adjacent to Darién/San Blas border, *Oliver et al. 3659* (MO, UC); trail from Punta Guayabo Grande to Río Jaqué, *Antonio & Hahn 4424* (MO).

PANAMÁ: NE of Cerro Azul, *Mori et al. 3789* (MO); Cerro Campana, *Hutchison 2970* (UC); Cerro Jefe, *Busey & Croat 280* (MO), *Croat 22665, 49095* (MO); S of El Llano near San Blas border, *Gentry 5820* (MO); W of El Llano, *Gentry 5101* (MO); El Llano-Cartí Road, *Croat 22850* (MO, NY), *25145, 33755, 49116* (MO), 33687 (F, MO, PMA, US), *Folsom et al. 1490* (MO, SEL), *Kennedy 2581* (MO), *Mori & Kallunki 2275* (MO), *Mori et al. 4616* (MO), *Nee 10488* (MO), *Tyson & Nee 7349, 7358, 7360* (MO); above Goofy Lake on road to Cerro Jefe, *Croat 15226* (MO); N of Margarita on road to Madroño, *Hammel 6008* (MO).

SAN BLAS: on the Río Acla, *Sugden 398, 435* (MO); El Llano-Cartí Road, *Sytsma & Andersson 4473* (MO).

VERAGUAS: NW of Santa Fe, *D'Arcy 10282* (MO), *Mori & Bolten 7620* (MO).

Anthurium hammelii Croat, sp. nov. TYPE: Panama. Bocas del Toro: ca. 5 km ENE of Cerro Pata de Macho near Finca Serrano, NE of Boquete, *Hammel 6160* (MO 2802252, holotype).

Planta epiphytica; cataphyllum subpersistens in fibris; petiolus 33–34 cm longus; lamina oblonga ad oblongo-elliptica, basi obtusa, 30–31 cm longa, 5.5–7 cm lata; inflorescentia foliis breviora; pedunculus usque 28 cm longus; spatha modice coriacea, purpurea, plus minusve rotundata, ca. 8.5 cm longa, 7 cm lata; spadix stipite 1.5 cm longo, cremeus, ca. 2.1 cm longus; baccae ignotae.

Epiphyte; stems ca. 1 cm diam.; internodes short; cataphylls weathering to subpersistent fibers. LEAVES with petioles 33–34 cm long, ca. 4 mm diam.; geniculum ca. 1 cm long; blades oblong to oblong-elliptic, acuminate at apex (the acumen flat, minutely apiculate), obtuse at base, 30–31 cm long, 5.5–7 cm wide, broadest at middle; upper surface semiglossy, epunctate; midrib raised above and below (dry); primary lateral veins 9–11 per side, departing midrib at 60° angle, arcuate to the collective vein, raised above and below (dry); lesser veins prominulous above and below (dry); collective vein arising from lowermost primary lateral vein, 3–5 mm from margin, raised above and below (dry). INFLORESCENCE shorter than leaves, peduncle to 28 cm long, ca. 3 mm diam.; equalling petioles; spathe moderately thick, violet purple, nearly round, ca. 8.5 cm long, 7 cm wide, broadest at middle, round and minutely apiculate at apex, cordate at base; stipe 15 mm long; spadix cream, ca. 2.1 cm long, ca. 8 mm diam. midway, cylindroid, rounded at apex; flowers rhombic, 1.5–2.4 mm long, 2–2.5 mm wide, 5–7 flowers visible in the principal spiral; tepals semiglossy, the lateral tepals 1–1.5 mm wide, the inner margins rounded; pistils not emergent; stigmas ellipsoid, drying raised; stamens exserted above the tepals, soon retracted to the level of the tepals; anthers held in a tight cluster around pistil, ca. 0.6 mm in both directions; thecae ovoid, scarcely divaricate. INFRUCTESCENCE not known. Fig. 86.

Anthurium hammelii is known only from the type collection made in Bocas del Toro Province, northeast of Boquete at 1,830 m in lower montane rain forest.

The sectional placement of the species is uncertain and awaits study of living material. Its inflorescence most closely resembles that of section *Calomystrium,* but its elongate leaves are unlike any others in the section. It is confused with no other species in the genus.

The species is readily distinguished by its oblong to oblong-elliptic, long petiolate blades, its rounded, cordate, violet purple spathe, and by its stipitate, short, cylindroid spadix.

The species is named in honor of Barry Hammel, who collected the only known specimen of this species.

BOCAS DEL TORO: ENE of Cerro Pata de Macho near Finca Serrano, *Hammel 6160* (MO).

Anthurium hebetatum Croat, sp. nov. TYPE: Panama. Coclé: La Mesa, above El Valle de Antón, ca. 2 km W of Cerro Pilón on slopes of steep hill, 860–900 m, disturbed virgin forest, *Croat 37415* (MO 2395376, holotype; CM, F, PMA, US, isotypes; Live at MO).

Planta epiphytica; cataphyllum subcoriaceum, fragile, persistens plus minusve intactum, denique deciduum; petiolus leviter camplanatus ad leviter sulcatus, interdum 1–2-costatus; lamina coriacea, oblonga ad oblongo-elliptica aut oblongo-ovata, basi leviter

cordata, (25–)39–85 cm longa, (6–)9–18.5 cm lata; inflorescentia effusa; pedunculus 11–32 cm longus, teres; spatha subcoriacea, pallide viridis, margine rubro-purpurea, lanceolata, plerumque fragilis, 5–12.5 cm longa, 1.5–2.2 cm lata; spadix viridis, 6–12.5 cm longus; baccae purpureae, obovoido-ellipsoideae, ca. 6 mm longae.

Epiphyte; stems 20 cm or more long, 1.5–3 cm diam.; internodes 1–2 cm long; leaf scars 1–1.5 cm wide; roots green to brownish, ca. 5 mm diam., smooth, descending; cataphylls subcoriaceous, brittle, 13–18.5 cm long, tinged violet, the epidermis cracking, acuminate at apex, held around petiole, drying tan, persisting more or less intact, ultimately deciduous. LEAVES spreading to pendent; petioles 10–44 cm long, 7–9 mm diam., weakly flattened to shallowly and sharply sulcate adaxially, sometimes faintly 1–2-ribbed abaxially, the epidermis turning gray to tan and cracking; geniculum 2–4 cm long; blades coriaceous, oblong to oblong-elliptic or oblong-ovate, acuminate at apex, rounded to shallowly lobed at base, (25–)39–85 cm long, (6–)9–18.5 cm wide, broadest near middle or just below; anterior lobe 38–81 cm long, the margins straight to weakly convex; posterior lobes 1–5.5 cm long (from apex of sinus to outermost point); sinus parabolic to hippocrepiform or sometimes spathulate; the surface matte, midrib acutely raised above, diminishing toward apex, convexly raised below; basal veins 3–5 pairs, usually free to the base, flat to prominulous above and below; primary lateral veins 12–20 or more per side, departing midrib at 30–35° angle, weakly sunken above, flat to prominulous below, interprimary veins flat above and below, lesser veins obscure; collective vein arising from the first basal vein, sunken above, prominulous below, 3–5 mm from margin. INFLORESCENCE spreading, shorter than leaves; peduncle 11–32 cm long, 5–9 mm diam., terete, one-third to one-half longer than petioles; spathe subcoriaceous, pale green, tinged red-violet at edges, lanceolate, usually brittle, 5–12.5 cm long, 1.5–2.2 cm wide, broadest at middle or below, acuminate at apex, rounded to acute at base, the margins weakly turned up, thin and cracking; spadix medium green (B & K Yellow-green 6/7.5), slightly tapered toward apex, 6–21.5 cm long, 5–11 mm diam. near base, 4–7 mm diam. near apex; flowers square to 4-lobed, 2.2–3.2 mm long, 2–2.7 mm wide, the sides sigmoid, 7–9 flowers visible in the principal spiral, 5–7 flowers visible in the alternate spiral; tepals semiglossy, minutely papillate, lateral tepals 0.7–1.9 mm wide, the inner margins straight and flat; pistils scarcely emergent, pale greenish white; stigma ca. 0.4 mm long; lateral stamens emerging nearly to apex of spadix before third and fourth stamens emerge; anthers white, 0.4–0.6 mm long, 0.3–0.7 mm wide, held over and covering pistil; thecae ellipsoid, not divaricate, pollen white. INFRUCTESCENCE with obovoid-ellipsoid, purple berries, ca. 6 mm long, 3–3.5 mm wide; mesocarp gelatinous with linear raphide cells; seeds 2, 2.8–3 mm long, ca. 2 mm wide, with minute appendage at apex, longer appendage at base. Figs. 89 and 93.

Anthurium hebetatum is endemic to Panama having been collected principally in Coclé Province in the vicinity of El Valle and north of El Copé. One sterile collection from Veraguas (*Croat 27782*) may also be this species. *Anthurium hebetatum* is found from 200 to 1,200 m in premontane rain forest.

The species is placed tentatively in section *Belolonchium* and is recognized by its coriaceous, oblong-elliptic to oblong-ovate, shallowly lobed leaf blades, its greenish spathe and spadix, its thick intact, but deciduous cataphylls, and by having the epidermis of the cataphylls and petioles cracking and flaking in age.

The species is closest to *Anthurium cinereopetiolatum,* which has similar thick cataphylls, coriaceous leaf blades, a greenish spathe and spadix, and reddish berries. Both species also have grayish cataphylls and petioles. *Anthurium hebetatum* differs from *A. cinereopetiolatum* in having broader, oblong-elliptic to oblong-ovate leaf blades. The blades of *A. cinereopetiolatum* are usually narrowly triangular or ovate-triangular and broadest near the base. In addition, the blade surfaces of *A. hebetatum* are matte whereas those of *A. cinereopetiolatum* are semiglossy.

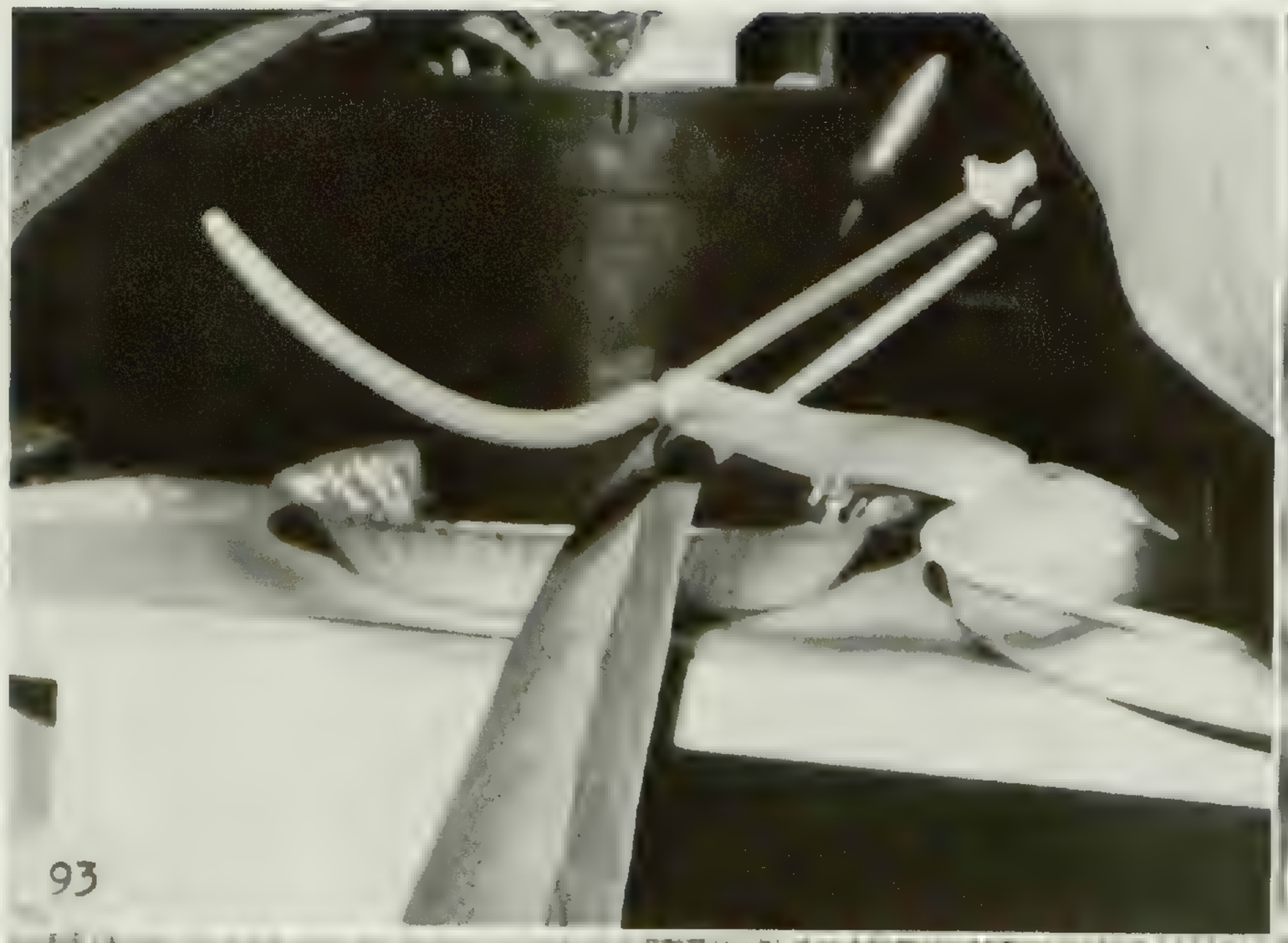
The name is derived from the Latin "hebetatus" meaning matte.

COCLÉ: Alto Calvario, *Croat 49147* (MO, US); Cerro Pilón, *Croat 22948* (MO), *Dwyer et al. 4520* (MO); vicinity El Copé, *Antonio 3257* (MO), *Croat 44709* (MO), *Hammel 2361* (MO); 5 hours walk from sawmill at El Copé, *Antonio 3608* (MO); El Valle behind Club Campestre, *Croat 14291* (MO, PMA); N of El Valle, *Allen 2204* (F); La Mesa above El Valle, *Croat 25323* (MO), *37415* (CM, F, MO, PMA, US), *Dwyer 11914* (MO, PMA), *Mori et al. 6604* (MO), *Nee & Dwyer 9207* (MO), *Wilbur et al. 15658* (DUKE); road from Llano Grande to Coclecito, *Hammel 1838, 1861* (MO).

VERAGUAS: valley of Río Dos Bocas, *Croat 27782* (MO).

FIGURES 85–88. 85. *Anthurium niqueanum* Croat, *Croat 37875*.—86. *Anthurium hammelii* Croat, *Hammel 6160*.—87. *Anthurium jefense* Croat, *Mori & Kallunki 2371*.—88. *Anthurium malianum* Croat, *Gentry 13705*.

FIGURES 89–92. 89. *Anthurium hebetatum* Croat, *Croat 37415*.—90. *Anthurium hornitense* Croat, *Croat 48706*.—91. *Anthurium kallunkiae* Croat, *Mori & Kallunki 5254*.—92. *Anthurium lancifolium* var. *albifructum* Croat, *Croat 33099*.



FIGURES 93–96. 93. *Anthurium hebetatum* Croat, *Croat 37415*.—94. *Anthurium hornitense* Croat, *Croat 48706*.—95. *Anthurium hutchisonii* Croat, *Croat 35968*.—96. *Anthurium hutchisonii* Croat, *Croat 49198*.

Anthurium hoffmannii Schott, Oesterr. Bot. Z. 8: 181. 1858. TYPE: Costa Rica. San José: Chica Uruca, *Hoffmann 571* (B, type destroyed; Photo of Schott Aroid Drawing #662; NYBG Neg. #N.S.3897).

Anthurium torresianum Engl., Bot. Jahrb. Syst. 25: 428. 1898. TYPE: Costa Rica. San José: San Francisco de Guadalupe, 1,100 m, *Tonduz 7176* (US, hololectotype; F, M, NY, isolectotypes; designated by Croat & Baker, 1979).

Epiphytic or terrestrial; stems to 60 cm or longer, cataphylls drying reddish brown, persisting intact; leaves with petiole erect-spreading, 20–90 cm long, 4–8 mm diam., terete or weakly sulcate; blades ovate, moderately thick, 14–55 cm long, 9–38 cm wide, deeply lobed at base. Inflorescence erect to slightly arching, peduncle 16–50 cm long, 1–4 mm diam., terete; spathe pale yellow-green, subcoriaceous, oblong-ovate to lanceolate, 6–13 cm long, 1.7–3 cm wide, stipe 6–10 mm long; spadix pale green becoming white or cream-colored, 4.5–8.5 cm long, ca. 8 mm diam. at middle; berries red, ovoid, ca. 8 mm long, ca. 5 mm wide; seeds 2. See Croat (1983: 302) for a more complete description.

Anthurium hoffmannii is found in Panama at 750 to 1,500 m in tropical wet, premontane rain, and lower montane rain forest life zones. It occurs in Coclé, Chiriquí, Colón, and Veraguas Provinces.

The species is in section *Calomystrium* and is related to *A. obtusilobum* and *A. formosum*. *Anthurium obtusilobum* differs in having the collective vein arising from the lowermost basal vein and continuing to the apex of the blade. *Anthurium formosum* differs in having a broader spathe that is whitish to pale violet. *Anthurium hoffmannii* is recognized by its thick, ovate to oblong-ovate, prominently lobed blade, its thick persistent reddish brown cataphylls, and by its pale green spathe and spadix.

CHIRIQUÍ: vicinity Boquete, *D'Arcy & D'Arcy 6479* (MO), *Davidson 461* (F, GH, MO, US), *Pittier 2872* (NY, US), *2965* (US), *Woodson et al. 1170* (F, MO); vicinity Cañas Gordas, *Croat 22345* (MO), *Liesner 229* (MO); vicinity Fortuna Dam site, *Correa et al. 2140* (MO), *Hammel 2189* (K, MO, PMA), *2218* (MO); road between Gualaca & Fortuna Dam site, *Croat 49820, 49902, 49998, 50038* (MO), *50092* (MO, PMA); NW of confluence of Río Hornito & Río Chiriquí, *Stevens 18379* (MO); above San Félix, *Croat 33155* (MO).

COCLÉ: Alto Calvario, *Folsom & Jaslon 2712A* (MO); near El Copé, *Correa et al. 3057* (MO).

COLÓN: Cerro Bruja, *Hammel 3116a* (MO).

VERAGUAS: Cerro Tute, N of Santa Fe, *Folsom & Mauseth 8332* (MO).

Anthurium hornitense Croat, sp. nov. TYPE: Panama. Chiriquí: along the road to Fortuna Dam site, N of Gualaca, 22.7 mi. beyond bridge over Río Esti, 1,400 m, 11.8 mi. N of Los Planes de Hornito, 10.7 mi. N of junction to tunnel, *Croat 48706* (MO 2737238, holotype; PMA, isotype; Live at MO).

Planta plerumque epiphytica, interdum terrestris; cataphyllum modice coriacea, persistens in fibris grossis; petiolus subteres interdum, leviter sulcatus, 16–55 cm longus; lamina anguste ovata ad triangulata, modice coriacea, basi leviter ad profunde cordata, 18–44 cm longa, 9–22 cm lata, pagina inferiore glanduloso-punctata; inflorescentia arcuato-pendula; pedunculus 34–48 cm longus, teres; spatha viridis interdum suffusa rubra, modice coriacea, lanceolata, 7–12 cm longa, 1.3–1.5 cm lata; spadix purpureus, 7–20 cm longus; baccae albae.

Usually epiphytic, sometimes terrestrial; stems green, to 20 cm long, ca. 4 cm diam.; internodes very short; leaf scars ca. 2.5 cm wide, sometimes obscured by cataphyll fibers; roots few, green, moderately thin, descending; cataphylls moderately thick, 6–8 cm long, acute at apex, drying brown (B & K Yellow 5/7.5) weathering to coarse fibers and persisting. LEAVES with petioles erect-spreading, 16–55 cm long, 4–6 mm diam., subterete, sometimes weakly sulcate; geniculum 2–3 cm long, scarcely thicker and paler than petiole, weakly sulcate; blades narrowly ovate to triangular, moderately thick, long-acuminate at apex, shallowly to deeply lobed at base, 18–44 cm long, 9–22 cm wide, usually broadest near the base, sometimes at point of petiole attachment; anterior lobe 17–34 cm long, the margins straight to weakly convex, posterior lobes 5–14 cm long, from apex of sinus to outermost point; sinus parabolic to hippocrepiform, rarely with the lobes overlapping; both surfaces matte to semiglossy, the lower surface dark, glandular-punctate, markedly paler; midrib convexly raised above, diminishing and sunken toward apex, convexly raised below; basal veins 4–6 pairs, first and sometimes second free to the base, those remaining coalesced 1.2–2 cm, flat to weakly sunken above, raised below, posterior rib naked, the outer margins weakly upturned; primary lateral veins 5–8 per side, departing midrib at 50–55° angle, straight to collective vein, sunken above, raised below; lesser veins scarcely visible, conspicuous on drying; collective vein arising from

one of the lowermost basal veins, sometimes from the first or second in smaller blades, loop-connecting the primary lateral veins, 4–6 mm from margin, sunken above, raised below. INFLORESCENCE arching-pendent, as long or longer than leaves; peduncle 34–48 cm long, 5–7 mm diam., terete; spathe pale green, sometimes tinged reddish, moderately thick, lanceolate, 7–12 cm long, 1.3–1.5 cm wide, broadest near base, strongly reflexed at anthesis, long-acuminate at apex, acute at base; spadix deep violet purple, 7–20 cm long, 8–15 mm diam. near base, 4–7 mm diam. near apex; flowers rhombic, 1.8–2 mm long, 2–2.1 mm wide, the sides straight to weakly sigmoid, 5–7 flowers visible in the principal spiral, 7–9 flowers visible in the alternate spiral; tepals matte, lateral tepals 0.6–0.8 mm wide, the inner margin convex; pistils not emergent; stigma linear, ca. 0.7 mm long; stamens emerging from the base, laterals first preceding alternates by 3–5 spirals; anthers yellowish, held over pistil, ca. 0.6 mm in both directions, thecae oblong, not divaricate. INFRUCTESCENCE with white berries. Figs. 90 and 94.

Anthurium hornitense is endemic to Panama and is known only from the Fortuna Dam Road, Cerro Hornito (the source of the first collection by Barry Hammel and thus the name *A. hornitense*), and on Cerro Tute near Santa Fe in Veraguas Province. It occurs in premontane rain and lower montane wet forest life zones at 1,300 to 1,850 m.

It is a doubtful member of section *Belolonchium* and is readily distinguished by its thick, glandular-punctate, cordate blades and violet purple tapered spadix; only one other cordate species in Panama (*Anthurium lentii*) has glandular punctations. It has scalariform venation with two or more pairs of collective veins roughly paralleling the midrib.

Anthurium hornitense is perhaps most closely related to *A. lucens* Standl. ex Yuncker, *A. veraguasense* Engl., and *A. chiapasense* Standl., all from Mexico or Middle America (to Honduras), but differs from all of them in having white rather than red to orange berries.

CHIRIQUÍ: Cerro Hornito, *Folsom et al. 7251* (MO), *Hammel 3050* (MO); road between Gualaca & Fortuna Dam site, *Croat 48706* (MO, PMA), *48752, 48803, 49899* (MO); N of Hornito on road to La Fortuna, *Hammel 6242* (MO).

VERAGUAS: slopes of Cerro Tute, *Croat 48926* (MO).

Anthurium hutchisonii Croat, sp. nov. TYPE: Panama. Panamá: Cerro Campana, Middle slopes, ca. 650 m, *Croat 35968* (MO 2389018, holotype; F, K, PMA, US, isotypes; Live at MO).

Planta epiphytica aut terrestris, caudex 1 m longus aut longiore, internodia, 3–7 cm longa; cataphyllum subcoriaceum, persistens circum caudex ad nodos superos; petiolus teres ad leviter camplanatus adaxiale, 13–40 cm longus; lamina ovato ad ovato-triangulata, modice membranacea, basi late ad profunde cordata, 16–46 cm longa, 9.5–28 cm lata; inflorescentia effusa, pedunculus teres, 9.5–20 cm longus; spatha subcoriacea, pallide viridis, linearis-lanceolata, 6–12 cm longa, 0.8–1.5 cm lata; spadix flavovirens, lutescens, 6.3–14 cm longus; baccae rubrae, ellipsoideae ad ovoideae.

Epiphytic or terrestrial from near the ground; stems 1 m or more long, 0.8–1.3 cm diam., the epidermis tan (closest to B & K Yellow-red 9/5), glossy; internodes 3–7 cm long; leaf scars ca. 1 cm wide; roots elongate, slender, descending; cataphylls subcoriaceous, 7–16 cm long, apiculate at apex, drying tan to light brown, persisting around stem at upper nodes, deciduous in lower portion of stem. LEAVES spreading, usually at apex of stem; petioles terete to weakly flattened adaxially, 13–40 cm long, 3–6 mm diam.; geniculum 1–3 cm long, weakly sulcate; blades ovate to ovate-triangular, moderately thin, long-acuminate at apex, broadly to deeply lobed at base, 16–46 cm long, 9.5–28 cm wide, broadest near the base; anterior lobes 4.5–38 cm long, the margins straight to convex or concave; posterior lobes 4–13 cm (from apex of sinus to outermost tip of lobe); sinus arcuate to parabolic to hippocrepiform, rounded at apex; the surface matte, usually drying conspicuously blackened, midrib acutely raised above, diminished and sunken toward apex, convexly raised below; basal veins 5–7 pairs, the first, sometimes second free, the remainder coalesced 0.7–3 cm, raised on both surfaces; posterior ribs naked, weakly turned up on outer margins; primary lateral veins 5–8 per side, departing the midrib at a 35–45° angle, usually straight, sometimes weakly arched to collective vein, sunken above, raised below; interprimary veins sunken above, prominulous below; secondary veins visible, flat; collective vein arising from one of the lowermost basal veins, loop-connecting with the basal and primary lateral veins, 4–9 mm from the margin, all veins drying darker than surface. INFLORESCENCE spreading; peduncles terete, 9.5–20 cm long, 3–5 mm diam.; spathe subcoriaceous, pale green (B & K Yellow-

green 7/10), linear-lanceolate, 6–12 cm long, 0.8–1.5 cm wide, broadest just above base, cuspidate at apex, rounded to subcordate at base, inserted on the peduncle at ca. 30° angle; stipe ca. 3 mm long; spadix yellow-green turning yellow, weakly tapered toward apex, 6.3–14 cm long, 5–11 mm diam. at base, 4–8 mm diam. at apex; flowers 4-lobed (1.8–)2.2–2.7 mm long, (1.8–)2–2.4 mm wide, the sides jaggedly sigmoid, ca. 6 flowers visible in the principal spiral, 8–10 flowers visible in the alternate spiral; tepals semiglossy, minutely and inconspicuously punctate, lateral tepals (0.7–)1–1.2 mm wide, the inner margin turned up against pistil; pistils scarcely emergent, green, same color as tepals; stigmas scarcely visible; stamens emerging from the base, lateral stamens emerging from base to apex, followed quickly by alternates; anthers white, 0.3–0.5 mm in both directions, held over pistil; thecae ellipsoid, tan; pollen creamy white. INFRUCTESCENCE with berries red, ellipsoid to ovoid, rounded at apex, 5–6.5 mm long, 3–4 mm diam., the mesocarp with linear to punctiform raphide cells in the apical half; seeds 2, broadly ellipsoid, rounded at both ends, 1.7–3 mm long, 2.2–2.5 mm wide, 1.1–1.3 mm thick, the appendage enveloping all of one side of seed and extending to ca. 1 mm beyond the seed on the apical end. Figs. 95 and 96.

Anthurium hutchisonii is known from Panama but is expected also in Colombia. It ranges from Chiriquí to Darién at 500 to 1,400 m in premontane rain forest.

The species is doubtfully placed in section *Xialophyllium*. It is recognized by its elongate, glossy, tan stems with generally long internodes, its broadly to deeply lobed, ovate to ovate-triangular blades that usually dry conspicuously blackened, and by its short-pedunculate inflorescence with a green, lanceolate spathe, a greenish yellow to yellow, tapered spadix, and red berries. Blade shape is variable with the margin varying from convex to concave.

The species is named in honor of Mr. Paul C. Hutchison (collecting for the University of California) who, along with Bob Dressler, made the first collection of the species in 1963. It is most easily confused with *Anthurium leptocaule*, which has a similar habit with elongate internodes and similar leaf blades. The latter differs, however, in having leaves that dry brown and a spadix that is creamy white rather than yellowish at anthesis.

CHIRIQUÍ: Fortuna Dam site, *Antonio 5031* (MO), *Croat 48699, 48700, 49073, 50044, 50084* (MO).

COCLÉ: Cerro Pilón, *Porter et al. 4355* (MO); Alto Calvario, *Croat 49164, 49198* (FTG, MO); Cerro Caracoral, *Sytsma 4076* (MO); vicinity El Copé, *Antonio 3252* (MO, PMA), *Croat 44560, 44744* (MO); El Potroso, *Folsom 1326* (MO), *Sytsma 1796, 1890, 1907* (MO), *Sytsma & Andersson 4608* (MO); vicinity La Mesa, *Croat 13355, 37409* (MO), *37369* (M, MO, PMA, US), *Gentry 7448* (MO), *Wilbur et al. 15662* (DUKE, MO).

COLÓN: S approach to Cerro Bruja, *Hammel 3160* (MO).

DARIÉN: summit of Cerro Pirre, *Gentry & Clewell 6993* (DUKE, MO), *7148* (MO); vicinity Tyler Kittredge on Río Tuquesa, *Croat 27282* (MO).

PANAMÁ: Cerro Campana, *Croat 14802, 22821* (MO), *17193* (F, MO, NY), *25220* (CAS, MO), *35968* (F, K, MO, PMA, US), *Hammel 3797* (K, MO), *Hutchison & Dressler 2972* (F, UC, US), *Kennedy 335* (F), *485* (DUKE, F, US), *1295* (DUKE), *Kirkbride 246* (MO), *Luteyn & Kennedy 1790, 1805, 1830* (DUKE), *Luteyn 3194* (DUKE, MO, US), *Madison 780* (GH), *Mori et al. 1925* (MO, NY, SEL), *Mori & Kallunki 2494, 3554* (MO, US), *Mori & Bolten 7681* (B, K, MO), *Sytsma 1158, 1159, 1175, 3535* (MO), *Witherspoon 8460, 8464* (MO); Cerro Jefe, *Sheffer 270* (MO).

VERAGUAS: vicinity Escuela Agricola Alto Piedra, *Mori & Kallunki 3259* (MO); slopes of Cerro Tute, *Croat 48935* (FTG, MO), *Sytsma & Andersson 4674* (MO); along the Santa Fe to Calovébora Road, *Croat 48994* (MO, PMA, SEL, US); NW of Santa Fe, *Mori et al. 3905* (MO), *Mori & Kallunki 6177* (MO).

Anthurium impolitum Croat, sp. nov. TYPE: Panama. Colón: along road between Portobelo and Nombre de Dios, 1.2 mi. beyond the junction of road to Isla Grande, 79°35′W, 9°40′N, *Croat 49792* (MO 2886024, holotype; F, K, NY, PMA, US, VEN, isotypes; Live at MO).

Planta terrestris; cataphyllum modice coriaceum, basi findens, apice persistens intactum; petiolus 14–57 cm longus, camplanatus ad leviter sulcatus; lamina subcoriacea, trilobata, (14–)20–44 cm longa, 24–42 cm lata, lobis lateralis plerumque falcatis; inflorescentia plerumque erecta; pedunculus teres, 17–38 cm longus; spatha subcoriacea, viridis, lanceolata, 9.5–12 cm longa, 1–1.5 cm lata; spadix plerumque viridis, interdum pallide luteus, 6–14 cm longus; baccae ignotae.

Terrestrial; stems 1–1.5 cm diam.; leaf scars obscured by roots and persisting cataphylls; roots moderately thin, descending; cataphylls moderately thick, 4.5–7 cm long, drying brown, splitting at the base, the apex persisting intact, ultimately deciduous. LEAVES erect-spreading; petioles 14–57 cm long, flattened adaxially to weakly sulcate; geniculum 1–1.5 cm long, more conspicuously sulcate; blades subcoriaceous, 3-lobed, acuminate at apex, shallowly lobed to

more or less rounded at base, (14–)20–44 cm long, 24–42 cm wide, broadest between base and midway from the outermost points of the lateral lobes; anterior lobe 20–44 cm long, 5–9(–18) cm wide, the margins convex; lateral lobes 13–27 cm long, 3–9.5 cm wide, usually falcate; sometimes extended at right angles to anterior lobe; both surfaces matte, the lower surface drying conspicuously paler; midrib narrowly and acutely raised above, convexly raised below with 1 or 2 ribs, these sometimes extending onto geniculum; basal veins 5–8 pairs, the first, sometimes second free to the base, third to sixth or seventh coalesced to 8 cm, the lowermost 1–2 coalesced to 4 cm, prominulous above, raised below; primary lateral veins 6–8 per side, departing midrib at 25–30° angle, acutely raised above, raised below, more or less straight to collective vein; lesser veins conspicuous above and below, flat above, prominulous below; collective vein of median lobe arising from one of the primary lateral veins, flat to scarcely sunken above, raised below, 3–5 mm from the margin. INFLORESCENCE usually erect; peduncle terete, 17–38 cm long, 4–5 mm diam.; spathe subcoriaceous, green, lanceolate, 9.5–12 cm long, 1–1.5 cm wide, acuminate at apex, acute at base; stipe 3–7 mm long; spadix usually green, sometimes pale yellow, 6–14 cm long, 5–6 mm diam. at base, 2–3 mm diam. at apex; flowers weakly 4-lobed (dried), 2–2.8 mm long, 1.5–2.5 mm wide, the sides sigmoid, 6–7 flowers visible in the principal spiral, 7–8 flowers visible in the alternate spiral; lateral tepals 0.6–0.7 mm wide, the inner margin convex; pistils scarcely emergent; stamens probably not exserted at anthesis, pollen white. INFRUCTESCENCE not seen. Fig. 102.

Anthurium impolitum is known for certain only from Panama in tropical wet forest at 150 to 900 m from Colón to Darién east of the Canal.

It is a member of section *Semaeophyllium* and is characterized by its generally terrestrial habit, its matte (thus its name *impolitum* meaning unpolished), prominently three-lobed leaf blades with a prominent naked posterior rib, and by its green to yellow-green, long-tapered spadix and oblong-lanceolate green spathe.

The species is perhaps most closely related to *Anthurium cineraceum,* but that species differs in having thicker blades that generally dry grayish rather than greenish or yellowish green as in *A. impolitum. Anthurium cineraceum* lacks a naked posterior rib and generally has longer more pointed lateral lobes. It is known only from Colombia and adjacent areas of Panama near the Colombian border.

Anthurium impolitum occurs with *A. garagaranum* in Colón Province of Panama near sea level but they can be distinguished even in sterile condition, the former being terrestrial with short internodes and matte, scarcely bicolorous blades, and the latter being a climber with the lower internodes elongate and glossy, having distinctly bicolorous blades.

A collection from the headwaters of the Río Tuquesa in Darién Province of Panama (*Croat 27116*) differs in having the lateral lobes less well developed, and it is placed in *Anthurium impolitum* with reservations.

Although herbarium material seems quite uniform, live material displays some vague vegetative variations. Further study of live material in flower may uncover two distinct species. Live plants of *Croat 49126* and *53541,* included as *Anthurium impolitum,* appear to have somewhat thicker, less veiny blades.

COLÓN: S approach of Cerro Bruja, *Hammel 3147* (MO); along road between Portobelo & Nombre de Dios, *Croat 49792* (F, K, MO, NY, PMA, US, VEN); Santa Rita Ridge, *Croat 13208* (MO), *Hammel & D'Arcy 6366* (MO).

DARIÉN: vicinity of upper gold mining camp of Tyler Kittredge, *Croat 27116* (MO).

PANAMÁ: El Llano-Cartí Road, *Croat 49126* (MO), *Kennedy et al. 3134* (MO); vicinity Cerro Jefe, *Croat 35935* (MO).

SAN BLAS: El Llano-Cartí Road, *Sytsma & Andersson 4480* (MO), *4513* (MO, PMA).

Anthurium interruptum Sodiro, Anales Univ. Centr. Ecuador 15: 301. 1902. TYPE: Ecuador. Growing in the W slopes of the Cordillera de Angamarca, Nov. 1899, *Sodiro s.n.* (B, holotype).

Anthurium radicosum Standl. & Steyerm., Publ. Field Mus. Nat. Hist., Bot. Ser. 23: 210. 1947. TYPE: Guatemala. Alta Verapaz: along Río Icvolay, 300–350 m, 6 Mar. 1942, *Steyermark 44776* (F, holotype).

Scandent epiphyte; stems elongate, 8–33 cm long; cataphylls drying brown, weathering and ultimately deciduous; petioles more or less terete, 1.8–13 cm long; blades lanceolate to elliptic, oblong-elliptic or oblanceolate, subcoriaceous, 5–21 cm long, 2.2–9.5 cm wide. Inflorescence erect-spreading; peduncle 4.5–14 cm long; spathe green, oblong-lanceolate, 3.7–5 cm long, 1–1.5 cm wide; spadix green, becoming brownish pur-

ple; berries red, broadly obovoid, ca. 7 mm long, flattened at apex with central depression. See Croat (1983: 307) for a more complete description.

The species is known from Guatemala to Panama, Ecuador, and surely also on the Pacific slope of Colombia. In Costa Rica and Panama it is known from premontane wet, tropical wet, premontane rain, and lower montane rain forest at elevations from 150 to 1,000 m. In Panama it is known from both the Atlantic and Pacific slopes.

Anthurium interruptum is provisionally placed in section *Xialophyllium* and can be recognized by its scandent stem with greatly elongated internodes alternating with two or more successive abbreviated internodes giving the appearance of several leaves being clustered at a node. In addition, no other scandent, entire-leaved species is known to have bright red berries.

CHIRIQUÍ: Cerro Pata de Macho, *Croat 48564* (MO); vicinity Fortuna Dam site, *Croat 48715* (MO), *Folsom et al. 5614, 5616* (MO); road between Gualaca & Fortuna Dam site, *Croat 49831* (MO, PMA).

COCLÉ: foothills & summit of Cerro Caracoral, *Knapp 1123* (MO); vicinity El Valle, *Allen 1812* (MO); La Mesa, *Croat 25401* (MO), *Gentry 5644* (MO); N of Llano Grande on road to Coclecito, *Hammel 1940* (MO); N of Penonomé, *Hammel 1623* (MO).

DARIÉN: Cerro Campamento, *Duke 15714* (MO), *Kirkbride & Duke 1223* (MO).

VERAGUAS: Cerro Tute, *Mori et al. 7556, 7557* (MO); vicinity Escuela Agricola Alto Piedra, *Mori & Kallunki 3128* (MO); headwaters of Río Caloveborita, *Sytsma & Andersson 4769* (MO); valley of Río Dos Bocas above Santa Fe, *Croat 27453* (MO); road from Santa Fe to Río Calovébora, *Croat & Folsom 34123* (MO); vicinity Santa Fe, *Liesner 951* (MO), *Mori & Kallunki 2539, 2540* (MO), *Mori et al. 3936, 3938* (MO).

Anthurium jefense Croat, sp. nov. TYPE: Panama. Panamá: road between Cerro Jefe and Altos de Pacora, near schoolhouse, 800–1,000 m, *Mori & Kallunki 2371* (MO 2253009, holotype).

Planta epiphytica; cataphyllum persistens in fibris tenuibus; petiolus sulcatus aut plus minusve adaxiale camplanatus, 4–15 cm longus; lamina subcoriacea, plerumque oblongo-elliptica ad oblanceolato-elliptica, raro oblongo-lanceolata, basi acuta, 8–17 cm longa, 2.2–4.4 cm lata, pagina inferiore glanduloso-punctata; inflorescentia plus minusve erecta; pedunculus teres, 7.5–22.5 cm longus; spatha modice membranacea, viridis suffusa rubra aut purpurea, lanceolata ad oblongo-lanceolata, 2.5–7 cm longa, 4–8 mm lata; spadix rubrus ad purpureus, 7–12 cm longus; baccae albae, subglobosae, 4–5 mm diam.

Epiphyte; stems more or less densely rooted, less than 10 cm long, 8–12 mm diam.; leaf scars hidden by cataphylls and roots; roots numerous, 2–3 mm diam., spreading or descending; cataphylls 2–3.5 cm long, drying reddish brown, promptly weathering to fine, persistent fibers, sometimes the apex more or less intact. LEAVES erect; petiole 4–15 cm long, 2–3 mm diam., sulcate or more or less flattened adaxially, the margins erect, rounded abaxially; geniculum 7–10 mm long; blades subcoriaceous, usually oblong-elliptic to oblanceolate-elliptic, rarely oblong-lanceolate, gradually to abruptly acuminate at apex (the acumen flattened and apiculate), acute at base, 8–17 cm long, 2.4–4.4 cm wide, broadest usually near middle; both surfaces semiglossy, eglandular above, densely and conspicuously glandular-punctate below; midrib prominently raised on both surfaces (dry); primary lateral veins 7–11 per side, departing midrib at 35–45° angle, drying prominulous or weakly etched above, prominulous below; interprimary veins only slightly less prominent than primary lateral veins on drying; collective vein arising from the base, 2–4 mm from margin, sunken above, raised below (dry). INFLORESCENCE erect; peduncle 7.5–15 cm long, 2–3 mm diam., terete, equalling or to twice as long as petioles; spathe moderately thin, green heavily tinged red or purple, lanceolate, 2.5–7 cm long, 4–8 mm wide, broadest just above the base, usually acute to obtuse and apiculate, rarely acuminate at apex, acute to obtuse or rarely rounded at base, inserted at ca. 45° angle on peduncle; stipe usually absent, sometimes to 3 mm long; spadix red to purple, scarcely tapered toward apex, 7–12 cm long, 3–4 mm diam. at base, 2–3 mm diam. near apex; flowers rhombic, 3.5–4 mm long 2.5–3 mm wide, 2–3 flowers visible in the principal spiral, 5–6 flowers visible in the alternate spiral; tepals semiglossy, lateral tepals 2.3–2.6 mm wide, the inner margin straight to broadly rounded; pistils not emergent, violet purple; stigmas broadly elliptic, ca. 0.3 mm long, 0.2 mm wide; stamens retracting beneath tepals after anthesis. INFRUCTESCENCE with berries white, subglobose, 4–5 mm diam., rounded at apex; seeds 4–6, narrowly ovoid-ellipsoid, pale brown, 1.3–1.5 mm long, 0.8–1 mm wide, often oblique at apex, rounded at base, with a sticky, transparent, gelatinous covering at both ends. Fig. 87.

Anthurium jefense is endemic to Panama with most collections made in the vicinity of Cerro

Jefe in Panamá Province at 1,000 to 1,200 m in premontane rain forest. A collection at about 400 m on the El Llano-Cartí Road (*Folsom 3595*) is probably also this species.

The species is a member of section *Porphyrochitonium* and is distinguished by its subcoriaceous, lanceolate-elliptic to oblong-elliptic, acuminate blades, its narrowly sulcate petioles usually shorter than the blades, its long-pedunculate inflorescence with a narrowly cylindroid, scarcely tapered, dark violet purple spadix, and by its white berries.

It is most easily confused with *Anthurium supraglandulum* with which it occurs on Cerro Jefe, but that species differs in having blades merely acute to bluntly acuminate at the apex and in having glands on the upper surface of the blade. Dried plants of *A. jefense* lack such glands on the upper surface.

PANAMÁ: vicinity Cerro Jefe, *Antonio 4720* (MO), *Dwyer et al. 5044* (MO), *Folsom 3611, 3832* (MO), *Folsom & Page 5946* (MO), *Mori & Kallunki 2371* (MO), *Porter et al. 5070* (MO), *Witherspoon 8584* (MO); El Llano-Cartí Road, *Folsom 3595* (MO).

Anthurium kallunkiae Croat, sp. nov. TYPE: Panama. Veraguas: NW of Santa Fe, 2 km beyond Escuela Agricola Alto Piedra, ridge top cloud forest below summit of Cerro Tute, above 1,200 m, *Mori & Kallunki 5254* (MO 2300023, holotype).

Planta epiphytica; cataphyllum persistens in fibris tenuibus; petiolus sulcatus, 2.5–5 cm longus; lamina sicce subcoriacea, oblongo-elliptica, basi acuta ad attenuata, 12–18 cm longa, 4.5–6.3 cm lata, utrinque glanduloso-punctata; inflorescentia erecta; pedunculus teres, 3.5–4.5 cm longus, spatha viridis ad pallide lutea membranacea, lanceolata, 3–3.5 cm longa, spadix viridis ad pallide luteus, 5.5–6 cm longus; baccae ignotae.

Epiphyte; stems densely rooted, less than 15 cm long, ca. 1 cm diam.; internodes short; leaf scars obscure, hidden by cataphylls and roots; cataphylls 3–4 cm long, promptly weathering to slender, light reddish brown, persistent fibers. LEAVES erect; petioles sulcate, often drying sharply 3-sided, 2.5–5 cm long, 2–3 mm wide; geniculum 6–10 mm long, drying blacker than the rest of the petiole; blades drying thickly chartaceous, oblong-elliptic, weakly acuminate at apex (the acumen thickly apiculate), acute to attenuate at base, 12–18 cm long, 4.5–6.3 cm wide, broadest usually at about the middle, both surfaces semiglossy, the upper surface densely whitish speckled, sparsely glandular-punctate, the lower surface paler, more conspicuously and densely glandular-punctate; midrib raised on both surfaces, often drying acute beneath; primary lateral veins 8–10 per side, departing midrib at 30–40° angle, moderately straight to the collective vein, relatively obscure above, prominulous below; interprimary veins usually much less distinct than the primary lateral veins; collective vein arising from the base, 2–5 mm from the margin. INFLORESCENCE erect; peduncles terete, 3.5–4.5 cm long, spathe green to yellow-white, thin, lanceolate, broadest at about the lower one-third, abruptly acuminate at apex, acute at base, the margins meeting irregularly, one often markedly lower than the other, inserted at 45° angle on peduncle; spadix green to light yellow, tapered toward apex, 5–6 mm diam. at base, 2.5–3 mm diam. near the apex; flowers rhombic, 2.5–3 mm long; 4–5 flowers visible in the principal spiral, 6–8 in alternate spiral; lateral tepals 0.9–1.7 mm wide, the inner margin more or less straight, the alternate tepals with the inner margin straight to concave; pistils not emergent; stigmas linear, ca. 0.5 mm long; stamens emerging just above the edge of the tepals, retracting completely after anthesis; anthers 0.3 mm long, 0.7 mm wide, the thecae ellipsoid, divaricate, opening broadly. INFRUCTESCENCE not known. Fig. 91.

Anthurium kallunkiae is endemic to Panama, known only from Veraguas Province in the vicinity of the type collection on Cerro Tute at over 1,000 m in what is probably lower montane wet forest.

The species, a member of section *Porphyrochitonium,* is distinguished by its epiphytic habit, its short stem with persistent, weathered cataphylls, its short-petiolate, lanceolate-elliptic, glandular-punctate leaves, and by its short pedunculate inflorescences (much shorter than the leaves) with light yellow spadices and yellowish white spathes.

The species is superficially similar to *Anthurium tacarcunense,* which has leaves of similar size that also dry somewhat grayish green, but in contrast to *A. kallunkiae* this species has longer petiolate leaves that are broadest above the middle and relatively longer petioles and peduncles.

The species is named in honor of Jackie Kallunki, one of the collectors of the type specimen.

VERAGUAS: NW of Santa Fe on Cerro Tute, *Mori &*

Kallunki 5254 (MO), *Mori et al. 7571* (MO), *Kress & Knapp 82-1413A* (DUKE).

Anthurium kamemotoanum Croat, sp. nov. TYPE: Panama. Panamá: Cerro Jefe at summit, 23.4 km from Pan-American Hwy., *Folsom 3831* (MO 2610308, holotype; K, PMA, isotypes; Live at MO).

Planta epiphytica aut terrestris; cataphyllum modice coriaceum, persistens intactum; petiolus teres, 32–55(–68) cm longus; lamina coriacea, late ovata, leviter bullata, basi profunde cordata, 15–37 cm longa, 11–28 cm lata; inflorescentia erecta, pedunculus 4–11.5 cm longus; spatha cupulata, ovato-elliptica, purpurea ad violacea, suffusa viridis, 6.5–8 cm longa, 4–5 cm lata; spadix sessilis, violaceus, 3–6 cm longus; pistillus albus, conspicue emergens; baccae ignotae.

Epiphyte or terrestrial; stem less than 10 cm long, 2–3 cm diam.; roots and leaf scars usually obscure, sometimes green to violet purple; cataphylls moderately thick, 9–17 cm long, sometimes tinged reddish, acute at apex with a minute subapical apiculum, drying reddish brown (B & K Yellow-red 3/10), persisting intact. LEAVES erect-spreading; petioles terete, 32–55(–68) cm long, 4–8 cm diam.; geniculum 3–6.5 cm long, weakly and narrowly sulcate; blades coriaceous, broadly ovate, weakly bullate, abruptly acuminate at apex, deeply lobed at base, 15–37 cm long, 11–28 cm wide, broadest at point of petiole attachment; anterior lobe 10–26 cm long, the margins broadly rounded; posterior lobes 6–14 cm long (from apex of sinus to outermost point); sinus hippocrepiform to obovate, rounded at apex; upper surface semiglossy, lower surface slightly glossier, somewhat paler; midrib convexly raised above, flat to scarcely sunken near apex, acutely raised below; basal veins 4–5 pairs, the first free, those remaining coalesced to 4.5 cm, paler than surface, raised above and below; posterior rib naked, weakly upturned on outer margin; primary lateral veins 3–5 per side, departing midrib at 50° angle, weakly arching to collective vein, weakly sunken above, raised below; interprimary veins visible, flat; lesser veins conspicuous on drying; collective vein arising from the first basal vein, loop-connecting the primary lateral veins, weakly sunken above, scarcely raised below, 3–13 mm from the margin. INFLORESCENCE erect, shorter than leaves; peduncle 4–11.5 cm long, 4–8 mm diam., ca. one-third as long as petioles; spathe cupulate, ovate elliptic, violet purple to deep red-violet (B & K Red-purple 2/10) tinged with green, glossy on both surfaces, held parallel to and cupped around spadix, curving forward with the acumen directed downward, 6.5–8 cm long, 4–5 cm wide, broadest at about the middle, apiculate at apex, rounded to obtuse at base, inserted at 45° angle on peduncle; spadix sessile, deep red-violet (B & K Red-purple 3/5–3/10), 3–6 cm long, 0.8–1.4 cm diam. midway; flowers rhombic to 4-lobed, ca. 1.5 mm long, ca. 2 mm wide, the sides straight to gradually sigmoid or obtusely angular, 8–9 flowers visible in the principal spiral, 10–12 flowers visible in the alternate spiral; tepals glossy, minutely and densely punctate, lateral tepals 1–1.3 mm wide, the inner margin rounded, turned up against pistil; pistil emergent, white, conspicuously raised before stamens emerge; stigmas linear, ca. 0.3 mm long, not conspicuously open before stamens emerge; stamens emerging sporadically throughout spadix, beginning near middle, exserted on translucent filament, 0.2–0.5 mm long, 0.3–0.4 mm wide, retracting to hold anthers at edge of tepals; anthers creamy white, 0.2–0.5 mm long, 0.4–0.6 mm wide; thecae ovoid, slightly divaricate; pollen creamy white. INFRUCTESCENCE not seen. Figs. 100 and 101.

Anthurium kamemotoanum is endemic to Panama and known only from the summit of Cerro Jefe at about 1,000 m in a premontane rain forest life zone.

A member of section *Calomystrium,* it is distinguished by its persistent, intact cataphylls, its broadly ovate, coriaceous blades that are dark green above with the major veins markedly impressed and much paler beneath, and especially by its short pedunculate inflorescence with the distinctly hooding, boat-shaped, dark violet purple spathe with the acumen directed downward and by its deep red-violet, cylindroid spadix with sharply protruding, slender whitish pistils.

The species is confused with no other species though its leaves are similar to those of *Anthurium roseospadix* with which it occurs on Cerro Jefe. The latter species, however, has an erect or spreading, usually white, spathe (not at all hooding) and lacks the protruding pistils.

The species is named in honor of Dr. Haruyuki Kamemoto of the University of Hawaii, who has made a significant contribution to this endeavor.

PANAMÁ: Cerro Jefe, *Folsom 3831* (K, MO, PMA), *Witherspoon et al. 8273* (MO).

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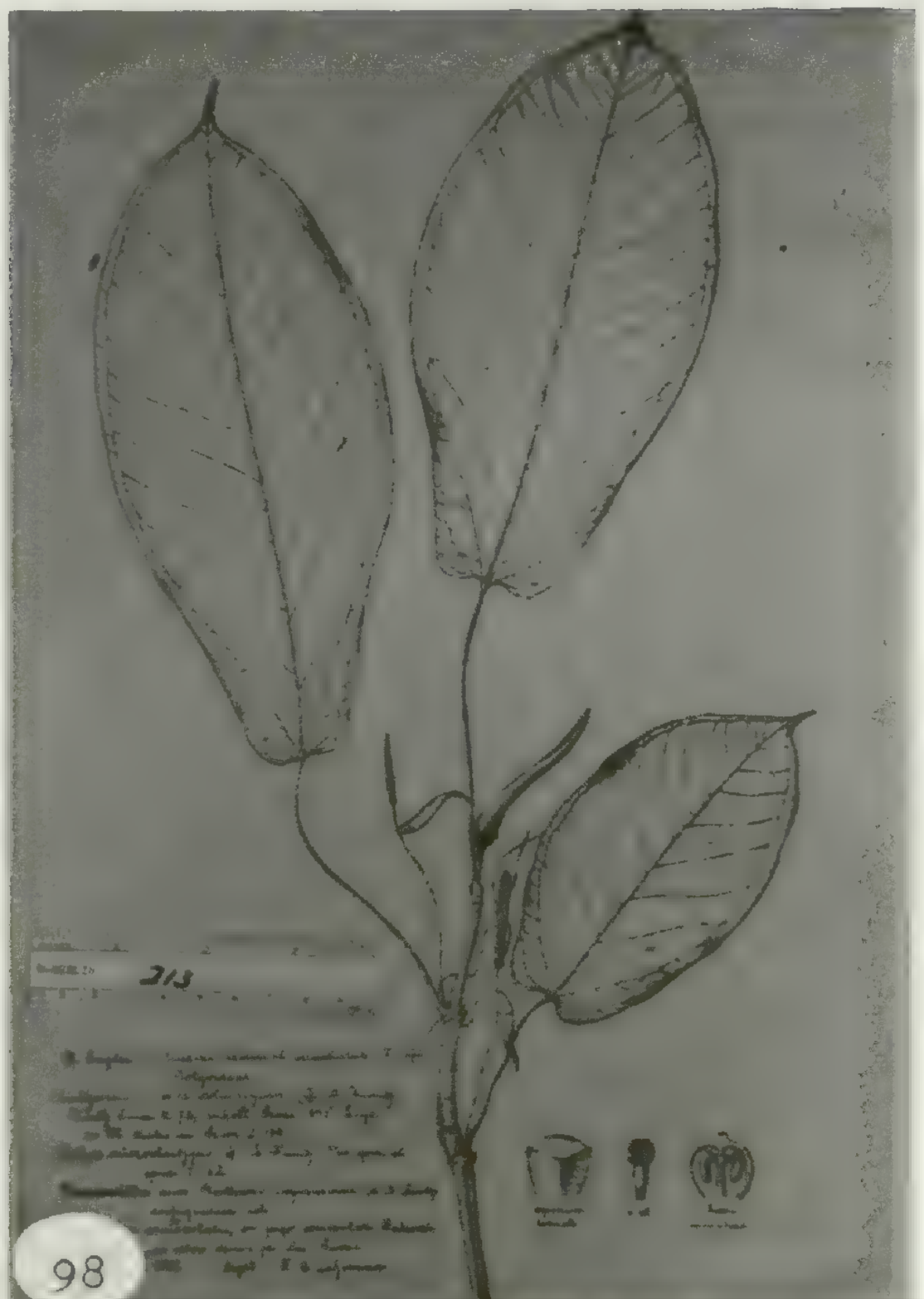

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FIGURES 97–100. 97. *Anthurium leptocaule* Croat, *Folsom 5873*.—98. *Anthurium myosuroides* (H.B.K.) Endl., *Lehmann 3877* (Drawing).—99. *Anthurium gracilispadix* Croat, *Croat 49999*.—100. *Anthurium kamemotoanum* Croat, *Folsom 3831A*.

Anthurium kunthii Poepp. in Poepp. & Endl., Nov. Gen. Sp. Pl. 3: 84. 1845. TYPE: Peru. Loreto: Maynas, *Poeppig s.n.* (W, type destroyed; isotypes?).

Epiphytic; scandent; stems usually to 1 m or longer, 1–1.5 cm diam., cataphylls drying yellow to tan persisting as linear fibers at each node; petioles 20–60 cm long, 2–3 mm diam., terete, shallowly sulcate; blades ovate, 22–60 cm long, 20–40 cm wide, 5, 7, or 9 pedatisect, the leaflets moderately thin, elliptic to ovate-elliptic, 7–27 cm long, 3–8 mm wide, acute to attenuate at base. Inflorescence spreading to arching; peduncle 20–55 cm long, terete; spathe green or sometimes slightly tinged purple, oblong-lanceolate, 5.5–15.5 cm long, 0.8–2.5 cm wide; stipe 5–9 mm long; spadix pale green fading to tan at anthesis, 7–21 cm long, 5–10 mm diam. at base; berries purple to violet purple. See Croat (1983: 307) for a more complete description.

Anthurium kunthii ranges from Nicaragua to Peru. In Panama it occurs in tropical moist and premontane wet forest on both slopes at elevations below 500 m.

Anthurium kunthii is in section *Dactylophyllium* and can be recognized by its palmately compound leaves, its long, slender peduncles nearly equalling the petioles in length, and by its slender, elongate, usually greenish spadix.

BOCAS DEL TORO: above Railroad Station at Milla 7.5, *Croat & Porter 16371* (MO), *38121* (MO, PMA); Isla Colón, *Wedel 614* (MO).

CANAL ZONE: Barro Colorado Island, *Croat 7090, 7310, 8238, 10086, 11602, 11700, 12940* (MO), *Shattuck 225* (MO).

COCLÉ: path from La Junta to Alto Calvario, *Folsom 5917* (MO).

COLÓN: Achiote, *Tyson et al. 4541* (MO); near Guásimo, *Croat 9952* (MO); Río Guanche, *Sytsma 1698* (MO); Santa Rita Ridge, *Knapp & Schmalzel 1764* (K, MO); near home of P. H. Zimmerman, *Folsom et al. 3328* (MO).

DARIÉN: NE of Jaqué, *Sytsma & D'Arcy 3416* (MO); Río Chico, *Burch 1113* (GH, MO, US), *Duke & Bristan 447* (MO); vicinity Campamento Buena Vista, *Stern et al. 868* (GH, MO).

PANAMÁ: NE of Cerro Azul, *Mori & Kallunki 3388* (MO); Cerro Jefe, *Luteyn 1322* (DUKE); El Llano-Cartí Road, *Croat 49121* (MO), *Hammel 880, 7345* (MO); Goofy Lake, *Sullivan 57* (MO); edge of Madden Lake, *Gentry & Tyson 5041* (MO).

SAN BLAS: headwaters of Río Mulatupo, *Elias 1766* (GH, MO).

Anthurium lactifructum Croat, sp. nov. TYPE: Panama. Darién: Serranía de Cañasas, vicinity of Tortí, 38.6 mi. E of Bayano Dam Bridge, trail from village to mountains near Río Tortí, ca. 250 m, *Antonio 4694* (MO 2802293, holotype; K, PMA, US, isotypes; Live at MO).

Planta epiphytica; cataphyllum persistens in fibris tenuibus; petiolus subteres, sulcatus, 7–18 cm longus; lamina coriacea, elliptica ad oblongo-elliptica, basi obtusa ad acuta, 19.5–23.2 cm longa, 6.5–9 cm lata; pagina inferiore, fusco-glanduloso-punctata; inflorescentia effusa; pedunculus 23–41 cm longus; spatha subcoriacea, pallide viridis suffusa violacea, lanceolata, 2.8–4.5 cm longa, 0.7–1.7 cm lata; spadix olivaceus lavandulascens per anthesin; baccae albae, subglobosae, ca. 6 mm longae, 5–8.3 mm diam.

Epiphyte; stems less than 10 cm long, ca. 1 cm diam.; leaf scars 8 mm wide; roots moderately thin, green, relatively long; cataphylls 2–3 cm long, drying brown, weathering into fine, persistent fibers. LEAVES spreading; petioles 7–18 cm long, 3.5–4 mm diam., subterete, bluntly and shallowly sulcate; geniculum 1.5–2.2 cm long; blades elliptic to oblong-elliptic, coriaceous, long-acuminate at apex, obtuse to acute at base, 19.5–23.2 cm long, 6.5–9 cm wide, broadest at middle; upper surface matte to semiglossy, eglandular, lower surface semiglossy, dark glandular-punctate; midrib convexly raised at base above, more acute midway, diminishing and sunken at apex, convexly raised below; primary lateral veins 8–12 per side, departing midrib at 40° angle, etched into surface above, flat to prominulous below, straight to collective vein; interprimary veins scarcely visible on both surfaces, drying more or less as prominent as primary lateral veins on lower surface; collective vein arising from the base, etched into surface, equally as prominent as primary lateral veins. INFLORESCENCE spreading, longer than leaves; peduncle terete, 23–41 cm long, 3–4 mm diam., 3–4 times longer than petioles; spathe subcoriaceous, pale green, tinged red-violet, lanceolate, 2.8–4.5 cm long, 0.7–1.7 cm wide, broadest near base, cuspidate at apex, acute and weakly decurrent at base, inserted at ca. 45° angle on peduncle; spadix olive green, becoming lavender at anthesis, tapered toward apex, 4.5–9.5 cm long, 4–5 mm diam. near base, 3–4 mm diam. near apex; flowers 4-lobed, ca. 3.5 mm long, ca. 2.8 mm wide, the sides sigmoid; 5–6 flowers visible in the principal spiral, 7–8 visible in the alternate spiral; tepals matte to semiglossy, weakly punctate, densely and minutely papillate, the lateral tepals 1–1.2 mm wide, the inner margins broadly rounded,

tinged purplish; pistils emergent, dark green tinged purplish; stigmas elliptic, ca. 0.4 mm long, more or less obscure, not exserted; lateral stamens emerging throughout, quickly followed by alternates in no apparent pattern; anthers white, 0.3 mm long, 0.6 mm wide, held at side of pistil, retracting after anthesis; thecae oblong, not divaricate; pollen white, quickly dispersing. INFRUCTESCENCE with white, subglobose, berries flattened at apex, sunken medially, ca. 6 mm long. 5–8.3 mm diam.; mesocarp thickly gelatinous; seeds usually 4, greenish white, bright green at apex, ca. 2.3 mm long, 1.4 mm wide, 1 mm thick, surrounded by a transparent sticky sac. Figs. 103 and 104.

Anthurium lactifructum is endemic to Panama in the Serranía de Cañasas in southeastern Panamá Province and eastern Darién Province at 15 to 85 m.

The species is a member of section *Porphyrochitonium* and is characterized by its coriaceous, elliptic to oblanceolate-elliptic, glandular-punctate leaf blades that are two and a half to three times longer than the petioles, its green lanceolate spathe, tinged red-violet, its dark olive green spadix, and by its truncate, white berries (thus the name "lacti" "fructum"). In leaf shape and texture, the species is closest to *Anthurium acutangulum* and *A. pirrense,* which both have much longer peduncles and spadices and blades with the major veins beneath more prominently raised.

DARIÉN: vicinity Río Tortí, *Antonio 4694* (K, MO, PMA, US).

Anthurium lancifolium Schott, Oesterr. Bot. Z. 8: 180. 1858.

a. Anthurium lancifolium var. **lancifolium.** TYPE: Costa Rica. Cartago: Volcán Turrialba, *Wendland 518* (GOET).

Anthurium allenii Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 66. 1940. TYPE: Panama. Coclé: N rim of El Valle, 800–1,000 m, *Allen 1854* (MO).

Anthurium firmum Engl., Bot. Jahrb. Syst. 25: 460. 1898. TYPE: Costa Rica. Puntarenas: Cañas Gordas, 1,100 m, *Pittier 11130* (B, holotype; BR, CR, isotypes).

Anthurium densinervium Engl., Bot. Jahrb. Syst. 25: 386. 1898. TYPE: Costa Rica. Along Río Hondo near Madre de Dios, 200 m, *Pittier 10346* (CR, holotype; B, isotype).

Epiphytic or terrestrial, 30–90 cm tall; stems 1–1.5 cm diam., cataphylls drying reddish brown, weathering into coarse fibers; petioles 15–45 cm long, 3–5 mm diam., obscurely and narrowly flattened adaxially sometimes with a faint medial rib; blades subcoriaceous, lanceolate to ovate-lanceolate or oblong-elliptic, 20–30(–50) cm long, 4–12 cm wide, cuneate at base. Inflorescence more or less erect; peduncle 26–60 cm long; spathe green, oblong-lanceolate, 4.3–8.5 cm long, 0.8–1.9 cm wide; spadix gray or greenish white, 4.5–9.5 cm long, 5–7 mm diam. at base; berries violet purple, ovoid to globose, ca. 3–5 mm wide; seeds white. See Croat (1983: 309) for a more complete description.

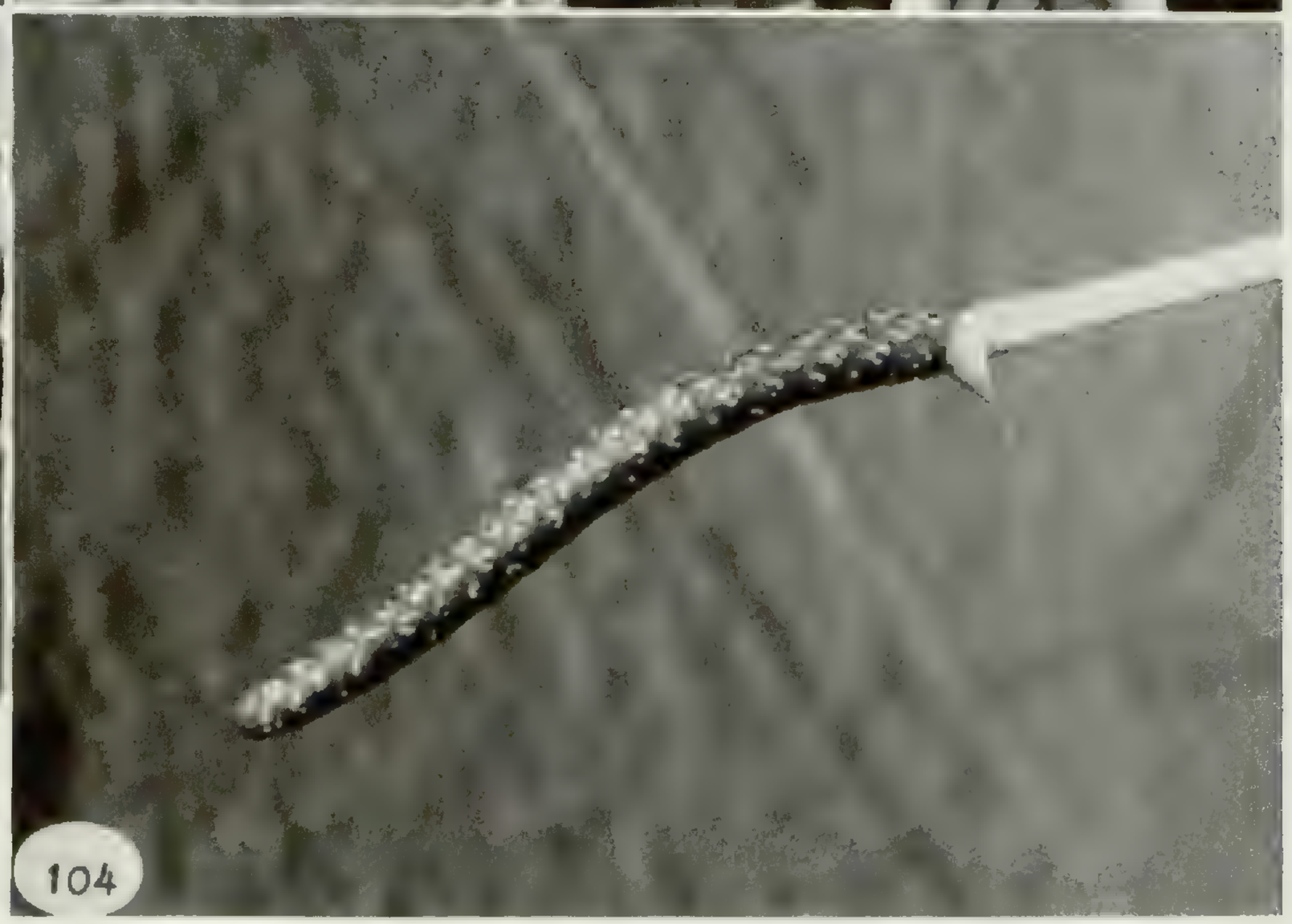
Anthurium lancifolium ranges from Nicaragua to Colombia (Antioquia and Chocó) at elevations of 500 to 1,600 m (especially 800 to 1,200 m) in regions of premontane wet, tropical wet, premontane rain, and lower montane rain forest life zones.

The species, a member of section *Porphyrochitonium,* is recognized by its frequently terrestrial habit, its short stems with persistent, weathered cataphylls, and by its generally elongate, gradually acuminate, glandular-punctate blades, which more or less equal the petiole in length. Also characteristic are its green, lanceolate spathe and especially its grayish white, moderately short, weakly tapered spadix that has stamens persisting after anthesis unlike most species in the section that promptly retract their stamens.

The species remains one of the most variable in the genus and further work may prove additional separation necessary. One collection (*Gentry & Mori 14097*) is particularly noteworthy in having blades that dry somewhat yellowish green like those of *Anthurium aureum* Engl. from South America. It does not, however, have the proper venation for that species and may prove to be a novelty. The collection was made on Cerro Tacarcuna near the Colombian border.

BOCAS DEL TORO: between Criollo & Quebrada Higuerón, *Kirkbride & Duke 782* (MO).

CHIRIQUÍ: NE of Boquete, *Hammel 5765, 7491* (MO); Cerro Colorado, *Antonio 4901* (MO), *Croat 37212, 48463* (MO), *Mori & Dressler 7846* (MO); Cerro Horqueta, *Luteyn 3074, 3075* (DUKE); Fortuna Dam site, *Correa et al. 2231, 2393* (MO), *Croat 48708, 48789, 48801, 49075, 49076, 49850, 49973, 49996* (MO), *Folsom et al. 5302, 8118, 8221* (MO), *Hammel 2084, 2093, 2171, 2230 2262* (MO), *Stevens 18441* (MO); vicinity Gualaca, *Antonio 5115, 5163, 5172* (MO); road between Gualaca & Fortuna Dam site, *Antonio 4089, 4091* (MO), *Croat 50012, 50103* (MO); vicinity San



FIGURES 101–104. 101. *Anthurium kamemotoanum* Croat, *Folsom 3831A.*—102. *Anthurium impolitum* Croat, *Croat 49126.*—103, 104. *Anthurium lactifructum* Croat, *Antonio 4694.*

Félix, *Croat 33138A* (MO), *Mori & Kallunki 5839, 5862* (MO); Monte Rey above Boquete, *Croat 15775* (MO).

COCLÉ: Alto Calvario, *Folsom 3181* (MO), *Folsom & Jaslon 2693* (MO), *Croat 49175* (MO); between Caño Sucio & Cerro Tife, *Antonio 3681* (MO), *Sytsma et al. 2566* (K, MO); Cerro Caracoral, *Knapp 1096* (MO), *1150* (K, M, MO), *Sytsma 3794, 3805* (MO); Cerro Pilón, *Croat s.n.* (MO), *Dwyer et al. 4491* (MO), *Mori et al. 6587, 6626, 6627* (MO); Continental Divide on road to Coclecito, *Hammel 2559, 3491, 3502* (MO); vicinity El Copé, *Antonio 1163* (MO), *Croat 44591, 44674* (MO), *Folsom 2339, 2877* (MO), *Folsom et al. 5690* (MO); *Hammel 1058, 2373, 2378, 3541, 4125* (MO); El Potroso, *Folsom & Collins 1564* (MO); vicinity El Valle, *Allen 1819* (MO), *Alston & Allen 1854* (MO), *Folsom 3116* (MO), *Lewis et al. 1751, 2555* (MO), *Nee & Dwyer 9142* (MO); La Mesa, *Croat 14400, 37388, 37470* (MO); road from La Pintada to El Copé, *Hammel 2603* (MO); vicinity Llano Grande, *Hammel 1954* (MO), *Sytsma 3969* (MO), *Sytsma et al. 4406* (K, MO); N of Penonomé, *Hammel 1625, 1730, 1738* (MO); Atlantic slope along Río San Juan, *Hammel 3435, 3456* (MO).

COLÓN: vicinity Cerro Bruja, *Hammel 3143, 3144, 3183* (MO), *Sytsma et al. 4255* (MO); Coclé del Norte, *Hammel 4458, 4518* (MO); near Guásimo, *Croat 9972* (MO); district of Portobelo, *Antonio 3821* (MO); headwaters of Río Boquerón, *Hammel 3935* (MO); Río Guanche, *Kennedy 1236* (DUKE, MO), *Mori & Kallunki 5186* (MO); Río Iguanitâ, *D'Arcy 11259* (MO); Santa Rita Ridge, *Antonio 3859* (MO), *Hammel 3649* (MO).

DARIÉN/CHOCÓ (COLOMBIA): Alturas de Nique, southernmost peak of Cerro Pirre massif, *Gentry et al. 28720, 28726* (MO).

DARIÉN: Cana-Cuasí Trail, *Terry & Terry 1580* (MO); SW ridge leading to Alturas de Nique, *Hartman 12426* (MO); Cerro Pirre, *Duke & Elias 13739* (MO), *Folsom & Mauseth 8577* (MO), *Gentry & Clewell 7030, 7103, 7149* (MO), *Mori & Kallunki 5472* (MO); Cerro Tacarcuna, *Gentry & Mori 14097* (MO, PMA); below Rancho Frio near top of Pirre Chain, *Folsom et al. 6355* (MO); Serranía del Darién trail from Cerro Mali to Río Pucuro, *Gentry et al. 16828* (COL, MO); vicinity Tyler Kittredge gold mine, *Croat 27123, 27186, 27238* (MO).

PANAMÁ: vicinity Altos de Pacora, *Croat 22763* (MO), *Mori et al. 6914* (MO); Capira, *Foster 2103* (DUKE); Cerro Campana, *Antonio 1723* (MO), *Bartlett & Lasser 16925* (MICH), *Croat 14197, 14699, 14748, 17204, 17233, 22776, 22819, 25200* (MO), *35992* (MO, PMA, US), *Gentry 4954* (MO), *Hammel 3742* (MO), *Kennedy 1546* (MO), *Lewis et al. 1905* (F, K, MO), *Liesner 604, 640* (MO), *Luteyn 954* (DUKE, MO), *1018, 3196* (DUKE), *Luteyn & Kennedy 1794, 1829* (DUKE), *Mori & Kallunki 2456* (MO), *Porter et al. 4257, 4968* (MO), *Sheffer 130* (MO), *155* (UH), *Witherspoon & Witherspoon 8449, 8911* (MO); vicinity Cerro Jefe, *Antonio 4730* (MO), *Croat 22678, 27084, 27095* (MO), *Hammel 3713* (MO), *Kennedy et al. 3362* (DAV, NY, U), *Kennedy & Dressler 3511* (F), *Knapp 1204* (MO), *Sheffer 106, 129* (MO), *187* (UH), *Tyson et al. 3355* (SCZ), *Witherspoon et al. 8277* (MO); NE side of Cerro Trinidad, *Foster 2114* (DUKE); El Llano-Cartí Road, *Croat 25140, 49108, 49136* (MO), *Nee & Tyson 10964* (MO), *Sytsma & Andersson 4441* (MO); N of Goofy Lake, *Folsom et al. 1966* (MO); La Eneida, *Luteyn & Kennedy 1747* (DUKE).

SAN BLAS: SE of Puerto Obaldía, *Croat 16794, 16797, 16833* (MO); S of Mandinga Airport, *Duke 14811* (MO).

VERAGUAS: Alto de Piedra, *Tam 15* (MO); NE slopes Cerro Delgadito, *Luteyn 4041* (MO); Cerro Tute, *Antonio 1824, 1854* (MO), *1841* (B, MO), *Croat 48929, 48953* (MO), *Folsom & Mauseth 8347, 8349* (MO), *Gentry 6263* (MO), *Luteyn 4041* (DUKE), *Sytsma & Antonio 3031* (MO), *Sytsma & Andersson 4628* (K), *4672* (K, MO), *4675* (MO), *Witherspoon et al. 8857* (MO); vicinity Escuela Agricola Alto Piedra, near Santa Fe, *Antonio 3478, 3480, 3979, 4932* (MO), *Croat & Folsom 33963* (MO), *Croat 48908* (MO); valley of Río Dos Bocas, road between Alto Piedra & Calovébora, *Croat 27386, 27499, 27705* (MO); vicinity Santa Fe, *Croat 23064* (MO), *Folsom & Collins 1619, 2957* (MO), *Hammel 4696, 4718* (MO), *Liesner 915, 1026* (MO), *Mori & Kallunki 5250, 5260, 6195* (MO), *Mori & Bolten 7670* (MO), *Nee 9719* (MO).

b. Anthurium lancifolium var. **albifructum** Croat, var. nov. TYPE: Panama. Chiriquí: N of San Félix, along mining road 18–27 mi. N of Pan-American Hwy. (above turn-off to Chame or Escopeta), 1,200–1,500 m, ca. 8°34′N, 81°52′W, *Croat 33099* (MO 2381151, holotype).

Planta terrestris; cataphyllum basi findens, apice persistens plus minusve intactum; petiolus teres, 22–38 cm longus; lamina crasse chartacea, anguste ovato-lanceolata, basi acuta ad leviter attenuata, 20–33 cm longa, 8–12 cm lata, pagina superiore inconspicuo glanduloso-punctata, pagina inferiore dense et conspicue glanduloso-punctata; inflorescentia erecta; pedunculus teres, 22–52 cm longus, modice membranacea, viridis, lanceolata, 3.5–6 cm longa, 5–15 mm lata; spadix albus aut pallide viridis, 4.5–5.5 cm longus; baccae albae, obovoideae.

Terrestrial herb; stems less than 12 cm long, 1–1.5 cm diam.; internodes short; leaf scars hidden by cataphylls and roots; roots spreading, relatively few, ca. 3 mm diam.; cataphylls 4–5 cm long, acuminate at apex, turning reddish brown and weathering to fibers at least at the base, the upper part remaining partly intact, sometimes merely shredding into longitudinal pieces interspersed with fibers. LEAVES erect-spreading; petioles terete, 22–38 cm long, 3–4 mm diam.; geniculum 1–1.5 cm long; blades thickly chartaceous, narrowly ovate-lanceolate, gradually long-acuminate at apex (the acumen flat, apiculate), acute to slightly attenuate at the base, 20–33 cm long, 8–12 cm wide, broadest below the middle; both surfaces semiglossy, the upper surface dark green (drying somewhat blackened), inconspicuously dark glandular-punctate; lower

surface much paler (drying yellowish green) densely and conspicuously dark glandular-punctate; midrib prominently raised on both surfaces; primary lateral veins 13–16 per side, departing the midrib at 45–50° angle, weakly curved to the collective vein, drying scarcely raised above, prominent below; interprimary veins drying equally prominent, the dried blade thus appearing to have numerous close primary lateral veins; collective vein arising from the base, 2–5 mm from the margin, weakly loop-connecting the primary lateral veins, weakly sunken on upper surface, prominent below. INFLORESCENCE erect; usually somewhat shorter than the leaves but held above them; peduncles terete, 22–52 cm long, 3–5 mm diam., usually longer than the petioles; spathe moderately thin, green, lanceolate, 3.5–6 cm long, 5–15 mm wide, broadest just above the base, acute and apiculate at apex, acute and decurrent at base, inserted at 45° angle on peduncle; spadix white to pale green, 4.5–5.5 cm long, 4–6 mm diam.; flowers square, 2.5–2.8 mm in both directions, 4–5 flowers visible in the principal spiral; lateral tepals 1.5–1.8 mm wide, the inner margin broadly rounded; pistils not emergent; stamens retracted beneath the tepals after anthesis. INFRUCTESCENCE erect, the spathe persistent; berries obovoid, white before maturity, becoming tinged with purple-violet at base at maturity, all the berries emerged throughout the spadix at full maturity, obovoid, rounded at apex, with punctiform raphide cells in the upper three-fourths of berry; seeds 2 (boiled up), oblong-obovoid, rounded at base, truncate or oblique at apex, 3.5–4 mm long, 2.4–2.6 mm wide, ca. 1.5 mm thick, flattened on one side, lacking any apparent appendage. Fig. 92.

Anthurium lancifolium var. *albifructum* is endemic to Panama in Chiriquí Province. All collections seen are from Cerro Colorado at 1,200 to 1,700 m in premontane rain forest.

This variety differs from the typical variety by having berries that are white before maturity, becoming faintly purplish at the base at maturity. The leaves also differ in variety *albifructum* in that they are narrowly ovate, rather than lanceolate and dry yellowish green on the lower surface. Most blades of the typical *lancifolium* dry rather dark.

CHIRIQUÍ: Cerro Colorado, *Folsom & Collins 1804* (MO), *Folsom 4882* (MO), *Mori & Dressler 7822* (MO); vicinity San Félix, *Croat 33099* (MO), *Mori & Kallunki 5885* (MO); Cerro Pata de Macho, *Knapp et al. 2052* (MO).

Anthurium lentii Croat & Baker, Brenesia 16(Supl. 1): 56. 1979. TYPE: Panama. Chiriquí: vicinity of Cerro Colorado Mine Development, 28 mi. above San Félix, 1,200–1,500 m, *Croat 33204* (MO 2381193, holotype; F, K, PMA, US, VEN, isotypes; Live at MO).

Epiphytic or terrestrial, 56–120 cm tall; stems usually short, stout, 2–3 cm diam., cataphylls turning brown, remaining intact, eventually splitting; petioles 10–70 cm long, (5–)8–9 mm diam., broadly sulcate above sheath, more deeply sulcate near apex with acute margins, rounded abaxially; blades ovate to narrowly ovate, coriaceous, semierect or spreading from petioles, truncate to subcordate or cordate at base, 15–50 cm long, 12.5–37 cm wide. Inflorescence erect to spreading; peduncle (23–)30–88 cm long, 5–10 mm diam., terete, frequently mottled with purple, two-thirds to three times longer than petioles; spathe coriaceous, green tinged with purple, narrowly ovate-oblong to oblong-lanceolate, (5–)8–14 cm long, (1–)2.8–3.9 cm wide, stipe 5–25 mm long; spadix violet purple, (6–)12–25 cm long, (6–)8–13 mm diam. at base; immature berries white, oblong-linear, square in cross-section, ca. 10 mm long; mature berries purple-violet, 1.3–1.5 cm long, ovoid and prominently beaked, the basal portion 6.5–8.5 mm diam., round in cross-section, the beak reddish violet. See Croat (1983: 310) for a more complete description.

The species ranges from Costa Rica to Colombia (mountains of northwest Chocó adjacent to Panama) at elevations of 350 to 1,800 m. It occurs only along the central cordillera. In Panama, the species has been collected in premontane wet, tropical wet, and lower montane wet forest from Cerro Colorado in Chiriquí Province to the Cerro Jefe region in Panamá Province and then appears again only near the Colombian border in Darién.

Anthurium lentii is in section *Digitinervium* and can be recognized by its thick, distinctively bicolorous, heavily punctate, truncate to cordate leaf blades with several heavy, prominently ascending basal veins. Another distinctive feature includes the prominently exserted pistils.

CHIRIQUÍ: Cerro Colorado, *Antonio 1505* (MO), *Croat 33204* (F, K, MO, PMA, US, VEN), *33343* (MO, PMA), *37220* (MO); Fortuna Dam site, *Folsom et al. 5567* (MO), *Hammel 2150, 2299* (MO).

COCLÉ: N of El Copé, *Croat 44731* (MO); top of El Potroso, *D'Arcy 11356* (MO); New Works at Rivera sawmill, *Folsom 3185, 3249* (MO).

COLÓN: S approach to Cerro Bruja, *Hammel 3190* (MO).

DARIÉN: top of Cerro Mali, *Gentry & Mori 13653* (MO); along headwaters of Río Tuquesa, *Croat 27127* (B, CAS, K, MO, NY, PMA, VEN).

PANAMÁ: Campo Tres, NE of Altos de Pacora, *Liesner 559* (MO); vicinity Cerro Jefe, *Croat 35902, 49096* (MO); El Llano-Cartí Road, *Croat 49119* (MO), *Liesner 690* (MO), *Mori & Kallunki 4118* (MO).

SAN BLAS: on Cartí Road from Pan-American Hwy., *Antonio 3784* (MO).

VERAGUAS: valley Río Dos Bocas on road between Alto Piedra & Calovébora, *Croat 27420* (MO); vicinity Escuela Agricola Alto Piedra, *Croat & Folsom 33960* (MO).

Anthurium leptocaule Croat, sp. nov. TYPE: Panama. Coclé: area between La Junta and Limón, 5 hour walk N of Alto Calvario, 800–1,000 m, *Folsom 5873* (MO 2639499, holotype; K, PMA, isotypes).

Planta terrestris; caudex gracilis, internodii 8–12 cm longi; cataphyllum membranaceum deciduum; petiolus teres, anguste camplanatus adaxiale, 16–34 cm longus; lamina ovata ad ovato-triangulata, basi cordata ad subcordata, 14–26 cm longa, 8.5–24 cm lata; inflorescentia semierecta; pedunculus teres, 10–13 cm longus; spatha pallide viridis, oblongo-linearis, 7.5–9 cm longa, 1.1 cm lata; stipite ca. 5 mm longo; spadix virellus-albus ad purpureus, 7.3–11 cm longus; baccae ignotae.

Terrestrial herb, 0.5–1 m tall; stems erect, green to grayish brown, drying gray; internodes 8–12 cm long, 6–8 mm diam.; roots few per node, ca. 1–2 mm diam., spreading; leaf scars inconspicuous; cataphylls thin, drying brownish, remaining more or less intact, persisting briefly at upper nodes, then deciduous. LEAVES few, persisting at uppermost nodes; petioles 16–34 cm long, 2–4 mm diam., terete, narrowly flattened adaxially; geniculum 10–12 mm long, obscurely sulcate; blades ovate to ovate-triangular, gradually to abruptly long-acuminate (the acumen flat, apiculate), cordate to subcordate at base, 14–26 cm long, 8.5–24 cm wide, broadest usually at the base; anterior lobe 14–30 cm long, the margins broadly rounded to straight, rarely slightly constricted near the base; posterior lobes 6–13 cm long (from apex of sinus to outermost point), directed mostly outward; sinus usually arcuate, sometimes hippocrepiform, rounded at apex; upper surface semiglossy, much paler and matte beneath; midrib acutely raised on both sides; primary lateral veins 3–7 per side, departing midrib at 40–50° angle, curved to the collective vein, weakly sunken above, raised beneath; interprimary veins usually not present; tertiary veins obscure above, conspicuous and darker green than the surface below; collective vein arising from one of the lowermost basal veins, 2–4 mm from the margin, loop-connecting the primary lateral veins. INFLORESCENCE semierect; peduncle 10–13 cm long, 2–3 mm diam., terete, one-third to three-fourths as long as the petioles; spathe pale green, oblong-linear, 7.5–9 cm long, 1.1 cm wide, acuminate at apex (the acumen narrowly inrolled), rounded at base, inserted at 45° angle on peduncle, drying with numerous minute raphide cells; stipe ca. 5 mm long, ca. 1.5 mm diam.; spadix greenish white to purple; scarcely tapered, 7.3–11 cm long, 4–5 mm diam. midway, 3–4 mm diam. near apex; flowers square, 2–2.2 mm diam. (dried), the sides moderately straight; 5–8 flowers visible in the principal spiral; tepals semiglossy, the lateral tepals ca. 1 mm wide, the inner margins broadly rounded; the pistils not exserted; stamens emerging promptly from the base, the laterals emerging throughout at least one-half of the spadix before the alternates emerge; filaments weakly exposed (at least on dried specimens); anthers (dried) narrowly ovate, 0.4–0.5 mm long, ca. 0.4 mm wide. INFRUCTESCENCE not seen. Fig. 97.

Anthurium leptocaule is endemic to western Panama in Chiriquí, Bocas del Toro, Veraguas, and Coclé Provinces at 900 to 1,500 m in premontane rain and lower montane rain forest.

It has been placed in section *Xialophyllium* and is distinguished by its long, slender stem (thus the name, from "lepto," meaning slender) with elongate internodes, its small thin, cordate, narrowly acuminate blades that dry brown, its slender, scarcely tapered spadix, and by its promptly deciduous spathe. The species is most closely related to *Anthurium hutchisonii,* which is generally a more robust plant with thicker stems that dry consistently blackened. The latter species, though widespread ranging from Chiriquí (Fortuna) to Darién in Panama, is chiefly from areas east of Veraguas and generally occurs below 1,000 m.

Anthurium leptocaule is one of the least understood species in Panama. Few specimens exist and reports of spadix color are inconsistent. The type specimen is reported to have a cream-colored spadix whereas *Folsom et al. 5460* from the Fortuna Dam area is reported to have a purple spadix.

BOCAS DEL TORO: between Quebrada Gutierrez & E slope of La Zorra, *Kirkbride & Duke 736* (MO).
CHIRIQUÍ: Fortuna Dam site, *Folsom et al. 5460* (MO).
COCLÉ: between La Junta & Limón, *Folsom 5873* (K, MO, PMA).
VERAGUAS: Cerro Tute, *Mori et al. 7565* (MO).

Anthurium llanense Croat, sp. nov.

Anthurium llanense spp. **llanense.** TYPE: Panama. Panamá: El Llano-Cartí Road in vicinity of Gorgas Lab Mosquito Control Project site at Km 12, ca. 400 m, *Croat 26013* (MO 2253328, holotype; F, K, NY, PMA, US, isotypes).

Planta epiphytica; cataphyllum subcoriaceum, findens in subpersistentibus fibris; petiolus subteres, leviter sulcatus, 1–6.5 cm longus; lamina oblanceolata ad oblonga, modice membranacea, basi obtusa ad rotundata, 12–28 cm longa, 2.5–8.5 cm lata; inflorescentia erecta; pedunculus teres aut leviter 1-costata; spatha coriacea, pallide viridis, cupulata, 1.6–2.5 cm longa, 1–1.5 cm lata; spadix stipite, 0.5–2 cm longo, atroviridis, subglobosus, 0.7–1 cm longus, 0.5–1 cm diam.; baccae purpureae, ovoideae ad ovoido-ellipsoideae, 9–10 mm longae.

Epiphyte; stems very short, 0.5–1 cm diam.; internodes short; leaf scars 4–6 mm wide; roots long, thin; cataphylls subcoriaceous, 3–4 cm long, caudate acuminate at apex, drying tan, weathering into subpersistent fibers. LEAVES spreading; petioles 1–6.5 cm long, 2–4 mm diam., subterete, weakly sulcate adaxially; geniculum ca. 0.5 cm long, only slightly thicker and more conspicuously sulcate than petioles; blade oblanceolate to oblong, moderately thin, short-acuminate at apex (the acumen minutely apiculate), obtuse to rounded at base, 12–28 cm long, 2.5–8.5 cm wide, usually broadest in upper third; upper surface semiglossy, lower surface matte to semiglossy; midrib acutely raised above, diminishing toward apex, raised below; primary lateral veins 6–20 per side, departing midrib at 35–60° angle, sunken above, raised below; lesser veins obscure; collective vein arising from the base, 5–8 mm from the margin, sunken above, raised below. INFLORESCENCE erect, usually shorter than leaves; peduncle 6–10 cm long, sometimes tinged purplish, terete or weakly 1-ribbed, 2–6 times longer than petioles; spathe coriaceous, pale green, cupulate, usually held close behind spadix or at up to 90° angle from peduncle, 1.6–2.5 cm long, 1–1.5 cm wide, broadest at middle or below, abruptly acuminate at apex, obtuse and clasping at base; spadix stipitate, 5–20 mm, dark green, subglobose, 0.7–1 cm long, 0.5–1 cm diam. midway; the flowers 4-lobed, ca. 3 mm long, 4 mm wide, the sides jaggedly sigmoid, ca. 3 flowers visible from any angle; tepals glossy, sparsely and obscurely punctate; minutely papillate, lateral tepals 1.5–1.9 mm wide, the inner margin convex; pistils raised, only slightly emergent, whitish; stigma ca. 0.5 mm long, elliptic, brush-like, exserted before stamens emerge; stamens emerging beginning at base, the laterals first, progressing quickly to apex, followed by alternates, exserted on translucent filaments, retracting to hold anthers at edge of tepals against pistil; anthers yellow-orange, ca. 0.5 mm long; thecae oblong, slightly divaricate; pollen yellow-orange, fading to pale orange to tan. INFRUCTESCENCE erect; spadix 2–3 cm long, 1.5–2 cm diam.; berries ovoid to ovoid-ellipsoid, purple, 9–10 mm long, 7–8 mm diam.; pericarp moderately thick; mesocarp with numerous, short raphide cells; seeds 1(–2), tan, ovoid to ovoid-ellipsoid, 7.5–8 mm long, 4.5–5.8 mm wide, weakly sunken at apex with a gelatinous, transparent, sticky appendage. Figs. 105 and 106.

Anthurium llanense ssp. *llanense* is known only from Central Panama, east of the isthmus in Colón, Panamá, and San Blas in premontane wet and tropical wet forest life zones at elevations of 350 to 700 m.

The species is tentatively placed in section *Urospadix* and is characterized by its small size, its usually oblong-oblanceolate, thin, epunctate leaf blades that dry green, and especially by its usually subglobose, very dark green, almost blackish purple spadix with prominently exserted pistils and pointed, purple berries. It is related to *Anthurium platyrhizum,* which differs in having a thick, short, cylindroid spadix, conspicuously flattened and densely positioned roots, and violet purple berries. It is also related to *A. wedelianum* that has an even longer, more tapered spadix with flowers that lack the prominently raised tepals and prominently exserted pistils of *A. llanense. Anthurium llanense* may be confused with *A. correae* with which it occurs, but that species is distinguished by its leaves that dry dark greenish brown to brown-black, a much longer inflorescence equal to or longer than the leaves (much shorter than the leaves in *A. llanense*), and by a long-stipitate oblong spadix.

COLÓN: Santa Rita Ridge Road, *Mori & Crosby 6417* (MO, PMA, US).
PANAMÁ: El Llano-Cartí Road, *Croat 26013* (F, K, MO, NY, PMA, US), *49115* (F, GH, K, MO, PMA,

SEL, US), *D'Arcy 10605* (MO), *Dressler 4228* (MO, PMA), *4373* (PMA), *Folsom 3486* (MO), *Folsom et al. 6185* (MO), *Kennedy 2700* (MO), *3409* (US), *Knapp & Hufi 4410* (MO), *Liesner 1122* (MO, US), *Maas & Dressler 1684* (U), *Mori & Kallunki 2317* (MO), *Sytsma 969* (MO).

SAN BLAS: Cerro Habú, *Sytsma et al. 2781* (MO); El Llano-Cartí Road, *Sytsma & Andersson 4470* (MO).

Anthurium longistipitatum Croat, sp. nov. TYPE: Panama. Chiriquí: along road between Gualaca and the Fortuna Dam site on the Río Chiriquí, 22.7 mi. beyond the bridge over the Río Estí, 11.8 mi. N of Los Planes de Hornito, 10.7 mi. N of jct. to tunnel, *Croat 48670* (MO 2738911, holotype; K, PMA, isotypes; Live at MO).

Planta epiphytica; cataphyllum modice coriacea, persistens in fibris grossis; petiolus teres, 4.5–36 cm longus; lamina modice coriacea, oblongo-lanceolata ad ligulata, basi obtusa ad rotundata, utrinque glanduloso-punctata; inflorescentia arcuata ad pendula; pedunculus teres 12–34 cm longus; spatha membranacea, viridis interdum purpurea, lanceolata, 2–10 cm longa, 4–10 mm lata; stipite 1–4 cm longo (raro 6 cm); spadix rubro-brunneus, atropurpurascens, 4.5–20 cm longus; baccae subglobosae, rubrae, ca. 5 mm diam.

Epiphyte; stems less than 20 cm long, 1.5–2 cm diam.; roots few, greenish to brown, descending; leaf scars ca. 1 cm diam.; cataphylls moderately thick, 3.5–6 cm long, drying reddish brown, soon weathering to coarse brown fibers, persisting around base of leaves and around stem. LEAVES erect-spreading; petioles 4.5–36 cm long, 2.5–3.5 mm diam., terete, green with sparse, inconspicuous, purplish glands; geniculum 1–1.5 cm long, weakly sulcate; blades moderately thick, oblong-lanceolate to strap-shaped, gradually acuminate at apex, obtuse to rounded at base, (9–)13–46 cm long, (1.5–)3–7 cm wide, broadest at about the middle (rarely below the middle), the margins straight, revolute; upper surface matte, obscurely dark glandular-punctate, weakly papillate; lower surface semiglossy, conspicuously dark glandular-punctate; midrib acutely raised above nearly to apex, obscurely raised near base below, flat toward apex; primary lateral veins (5–)10–20 per side, departing midrib at ca. 45° angle, scarcely visible above, weakly sunken below, drying prominulous above and below; lesser veins inconspicuous, drying prominulous; collective veins arising from the base, straight or weakly loop-connected, 3–6 mm from margin. INFLORESCENCE arching to pendent, shorter than leaves; peduncle erect to arching, terete, faintly tinged red-violet, 12–34 cm long; spathe thin, green, sometimes violet purple or only the margins tinged violet purple, lanceolate, 2–10 cm long, 4–10 mm wide, broadest near the base, abruptly acuminate at apex, usually withering promptly, inserted at a 10° angle on peduncle; stipe 1–4 cm long (rarely to 6 cm), green; spadix reddish brown, becoming dark violet purple, 4.5–20 cm long, 4 mm diam. midway, slightly tapered to apex; flowers weakly 4-lobed, 2.5–3 mm in both directions, the sides more or less straight parallel to spirals, sigmoid perpendicular to spirals, 3–4 flowers visible in the principal spiral, 6–8 flowers visible in the alternate spiral; tepals glossy, lateral tepals 1.4–1.8 mm wide, the inner margin broadly rounded; pistils weakly raised, reddish purple; stigma linear, ca. 0.3 mm long; stamens emerging rapidly, beginning near the base, the laterals emerging to the middle or just above before the first alternate emerges, the third stamen preceding the fourth by only ca. 2 spirals, persisting after anthesis; anthers white, held at sides of pistil just above tepals, ca. 0.3 mm long, 0.6 mm wide; thecae more or less rounded, slightly divaricate; pollen yellow, fading to white. INFRUCTESCENCE pendent; berries subglobose, red, ca. 5 mm diam.; mesocarp gelatinous; seeds 1, tan, weakly flattened, 2.5–2.7 mm long, 1.5–2 mm wide, 0.7–1 mm thick. Figs. 107 and 108.

Anthurium longistipitatum is endemic to Panama in Chiriquí Province at 1,250 to 1,700 m in premontane and lower montane rain forest. Most collections are from the Fortuna Dam site but the species is known also from Cerro Colorado, north of San Félix and from Cerro Pata de Macho, northwest of Boquete.

Anthurium longistipitatum, a member of section *Porphyrochitonium,* is recognized by its pendent habit (usually suspended by only a few roots), its short, slender stem with cataphylls persisting as coarse fibers, and by its moderately long-petiolate, coriaceous, glandular-punctate, generally strap-shaped, gradually acuminate leaves. Also characteristic are its long-pedunculate inflorescence with a generally long-stipitate (thus the name), long, slender, reddish brown to violet purple spadix and its small, globular, red berries.

Anthurium longistipitatum is perhaps most easily confused with *A. circinatum,* which differs in having proportionally much shorter, ovate-oblong leaves that are usually broadly rounded at the base. The latter also has flowers that differ

FIGURES 105–108. 105. *Anthurium llanense* Croat, *Croat 49115.*—106. *Anthurium llanense* Croat, *Croat 26013.*—107. *Anthurium longistipitatum* Croat, *Croat 33402.*—108. *Anthurium longistipitatum* Croat, *Croat 48670.*

in that they are proportionately larger with the lateral tepals having thin margins drying about three times wider in the direction of the axis than perpendicular to the axis. In contrast, the flowers of *A. longistipitatum* have thick margins and dry less than two times longer in the direction of the axis. In addition, *A. circinatum* has stamens that are prominently exserted on dried specimens whereas those of *A. longistipitatum* are usually scarcely or not at all exserted on dried specimens. One collection, *Mori & Kallunki 5853* from Cerro Colorado, is unusual in that the stamens are somewhat exserted. For additional characteristics separating the two species see the discussion of *A. circinatum.*

Anthurium longistipitatum is also related to *A. chiriquense* but that species differs in having thinner, oblong-elliptic blades that are prominently three-veined with the collective veins arising at an acute angle to the midrib at the base. In contrast, the collective veins of *A. longistipitatum* are diminished toward the base and follow the margin more closely.

Smaller collections of *Anthurium wendlingeri* may also be confused with *A. longistipitatum* but that species ranges no further west than Veraguas in Panama and extends no higher than 900 m. It also has much thicker, more elongate blades with the collective vein proportionately more remote from the margin and a longer, proportionately less stipitate spadix that is grayish white or cream-colored at anthesis and produces orange berries.

BOCAS DEL TORO: ENE of Cerro Pata de Macho, *Hammel 6171* (MO).

CHIRIQUÍ/BOCAS DEL TORO: along path from Chamí into Bocas, *Folsom 6135* (MO).

CHIRIQUÍ: Fortuna Dam site, *Croat 48670* (K, MO, PMA), *48753, 48762, 49818, 49933, 50029* (MO), *48753* (MO, NY), *49888* (CAS, F, K, MO, PMA, US), *Folsom et al. 5400* (MO), *Hammel 2125* (MO), *Sytsma & Stevens 2205* (MO); road between Gualaca & Fortuna Dam site, *Antonio 4082* (MO); N of Hornito on road to La Fortuna, *Hammel 6248* (MO); above San Félix on mining road to Cerro Colorado, *Croat 33402* (MO); N of San Félix at Chiriquí & Bocas del Toro border, *Mori & Kallunki 5853* (F, MO, PMA).

Anthurium luteynii Croat, Selbyana 5: 324. 1981.

TYPE: Panama. Veraguas: Río Primero Braso, 2.5 km beyond Escuela Agricola Alto Piedra, beyond Sante Fe, 700–750 m, *Croat 25521* (MO 2827506–08, holotype; B, CAS, F, K, NY, PMA, SEL, US, VEN, isotypes; Live at MO).

Rosulate epiphyte or terrestrial in deep humus; internodes short; roots woody, brown, descending; cataphylls coriaceous, 10–23 cm long, minutely apiculate and inequilateral at apex, drying tan, the apex remaining intact as reticulate fibers, subpersistent. LEAVES held nearly erect; petioles 9–45 cm long, 1.5–2.5 cm wide, sharply sulcate, more or less trapezoidal in cross-section, the abaxial surface 3-ribbed, the ribs continuing onto geniculum and lower third of midrib; geniculum 1–2 cm long, much thicker than petiole; blades elliptic-oblong to oblong-lanceolate, coriaceous, gradually to abruptly acuminate at apex (the acumen downturned, blunt), acute with upturned edges at base, 50–125 cm long, 9–23 cm wide, broadest near middle; both surfaces matte to semiglossy; midrib flat near base above, convexly raised at middle, becoming acutely raised and then diminishing at apex, sharply raised below, 3-ribbed in basal third; primary lateral veins 10–25 per side, departing midrib at ca. 60° angle, prominulous in valleys above, raised below, slightly arcuate-ascending; interprimary veins sunken above, flat or slightly raised below; collective vein arising from one of the primary lateral veins in the lower one-fourth of the blade, sometimes arising from a primary lateral vein nearer the apex, loop-connecting the primary lateral veins except near the base, sunken or more or less obscure, 3–10 mm from margin, flat above, raised below. INFLORESCENCE erect-spreading and slightly arching, equal to or half as long as leaves; peduncle 49–85 cm long, 1.3–1.7 cm diam., much longer than the petiole, green to violet purple, with a prominent rounded rib adaxially, more prominently ribbed abaxially, the ribs somewhat twisted; spathe coriaceous, dark purple, cucullate, narrowly ovate to oblong-lanceolate, 9–33.5 cm long, 2–11 cm wide, broadest ca. one-third from the base, acuminate to caudate-acuminate at apex (the acumen 3–4 cm long, sometimes curled down toward spadix), cupped around base of spadix, decurrent ca. 5 mm onto peduncle and joining rib of peduncle, the margins of the spathe joining the peduncle 0.3–1 cm apart, not meeting, inserted at ca. 60° angle on peduncle; spadix violet purple, 7–17 cm long, 0.8–2.8 cm diam. near base, 0.5–1.7 cm diam. near apex; flowers rhombic to slightly 4-lobed, 2–3.6 mm long, 1.8–3 mm wide, ca. 15 flowers visible in the principal spiral, ca. 15 flowers visible in the alternate spiral, the sides straight to jaggedly sigmoid; tepals matte to semiglossy, minutely punctate, covered with a dust-like waxy bloom (at least when dry), the lateral tepals 1.2–1.5 mm

wide, the inner margin flat against pistil, turned up when dry; pistils exserted ca. 0.5 mm when anthers are emerging, green at base, purplish brown at apex, the stigma ca. 1 mm long, producing copious stigmatic droplets for 3–4 weeks before stamens emerge; stamens emerging irregularly throughout spadix, lateral anthers emergent throughout before first pairs of alternate anthers appear, anthers cream-colored, ellipsoid, 0.4–0.5 mm long, 0.6–1 mm wide, opening with pollen exposed as they emerge; thecae weakly rounded, slightly divaricate; pollen white. INFRUCTESCENCE erect or spreading; spathe cucullate; spadix 20–25 cm long, to 4 cm wide; berries orange, oblong-ellipsoid, pointed at apex, 10–19 mm long, 5–8 mm diam., pericarp thick, opaque in apical half, translucent in lower half with a few raphide cells near the middle; mesocarp pulpy; seeds 2, oblong, tan, weakly beaked at both ends, 4–6.5 mm long, 2–2.7 mm diam., slightly flattened, ca. 2 mm thick. Figs. 109 and 110.

The species is known only from Panama on both slopes in tropical wet and premontane rain forest life zones at elevations of 600 to 900 m.

Anthurium luteynii is a member of section *Pachyneurium* and is characterized by its coriaceous, more or less narrowly oblanceolate leaves and its somewhat trapezoidal petiole that is prominently three-ribbed abaxially and sharply sulcate adaxially. Also characteristic are its stout, semierect inflorescence with a broad, often cucullate, purplish spathe and violet purple spadix and its long, sharply pointed, orange berries.

Although initially confused with *Anthurium seibertii* because of its orange, pointed berries and its coriaceous, persistent, intact cataphylls, the species is not believed to be closely related to that species or to any other known species. *Anthurium seibertii* differs principally in having thinner, strap-shaped leaves that always have the collective vein arising from near the base and in having a narrowly tapered, much paler violet purple spadix.

COCLÉ: NE of El Copé, *Antonio 1140* (MO); vicinity El Valle, *Allen 2694* (F), *Croat 37416* (MO), *Folsom 2785* (MO), *Luteyn 3162* (DUKE, MO); trail beyond La Mesa towards Los Llanos, *Luteyn 3163* (DUKE).

DARIÉN: along headwaters of Río Tuquesa, vicinity Tyler Kittredge gold mine, *Croat 27120, 27156, 27169* (MO).

VERAGUAS: W of Alto de Piedra, *Hammel 4669* (MO); along first branch of Río Santa Maria on road from Santa Fe, *Witherspoon & Dressler 8923* (MO); Rio Primero Braso, near Santa Fe, *Croat 25521* (B, CAS, F, K, MO, NY, PMA, SEL, US, VEN); vicinity Santa Fe, *Croat & Folsom 33993* (MO), *Croat 48909, 49044* (MO), *49071* (FTG, MO), *Mori & Kallunki 4751* (MO).

Anthurium madisonianum Croat, sp. nov. TYPE: Panama. Chiriquí: along road from Gualaca to Fortuna Dam site, 5.9 mi. NW of Los Planes de Hornito, 1,370 m, 82°12′W, 8°43′N, *Croat 49883* (MO 2769028–29, holotype; PMA, US, isotypes; Live at MO).

Planta epiphytica; cataphyllum modice membranaceum, persistens in fibris grossis; petiolus plerumque teres, (15–)36–47(–70) cm longus; lamina subcoriacea, profunde trilobata, lateralis lobis interdum falcatis, plerumque ad angulum rectum a lobo mediano, 25–60 cm longa, 26–56 cm lata; inflorescentia effusa; pedunculus 24–52 cm longus; spatha viridis interdum suffusa rubro-violacea, lanceolata, 10–20 cm longa, 2–2.8 cm lata; stipite 1 cm longo; spadix rubro-violaceus, 9–20 cm longus; baccae subglobosae, albae aut albae apice suffuso rubro, 3–3.5 mm longae.

Epiphyte; stems green, ca. 20 cm long, ca. 3.5 cm diam.; leaf scars 2–2.5 cm wide; roots moderately thin, smooth, descending; cataphylls moderately thin, 6–9 cm long, drying brown (B & K Yellow 3/7.5), weathering to coarse fibers and persisting. LEAVES spreading; petioles usually terete, (15–)36–47(–70) cm long, 4–8 mm diam.; geniculum 1–2 cm long; blades subcoriaceous, deeply 3-lobed, the lateral lobes falcate in larger blades, at a more or less right angle to median lobe in younger leaves; 25–60 cm long, 26–56 cm wide, the median lobe 25–60 cm long, 4–11 cm wide midway, lateral lobes 12.5–46.5 cm long, 3–12 cm wide at widest point; upper surface semiglossy, lower surface matte and paler than upper surface; midrib acutely raised above, sunken toward apex, convexly raised at base below, more acute toward apex; basal veins 3–6 pairs, the first sometimes free, usually coalesced 1–4 cm, those remaining coalesced 4.5–15 cm, forming a thick posterior rib; primary lateral veins 4–5 per side, departing midrib at 25–35° angle, sunken above, raised below, straight to collective vein, lesser veins scarcely visible, more conspicuous on drying; collective vein of median lobe arising from first basal vein or from one of the lowermost primary lateral veins, sunken above, raised below, 2–3 mm from margin. INFLORESCENCE spreading, shorter than leaves; peduncle 24–52 cm long, 2–6 cm diam.; spathe green, sometimes tinged red-violet, lanceolate, 10–20 cm long, 2–2.8 cm wide, acuminate at apex, acute at base; stipe to 1 cm long; spadix

FIGURES 109–112. 109, 110. *Anthurium luteynii* Croat, *Croat 37416.*—111, 112. *Anthurium pittieri* var. *morii* Croat, *Croat 49180.*

red-violet, narrowly tapered toward apex, 9–20 cm long, 7–9 mm diam. near base, 5–6 mm diam. near apex; flowers rhombic to 4-lobed, 1.7–2.5 mm long, 1.3–2.2 mm wide, the sides straight to weakly sigmoid, 7–8 flowers visible in the principal spiral, 6–8 flowers visible in the alternate spiral; tepals glossy, lateral tepals 0.4–0.6 mm wide, the inner margin convex; pistils emergent; stigmas elliptic ca. 0.5 mm long; stamens barely emerging (retracted beneath the edge of the tepals upon drying), the laterals appearing throughout most of the spadix before the alternates emerge; anthers 0.7 mm wide, 0.2 mm long (dried), the thecae divaricate at a broad angle; pollen white. INFRUCTESCENCE with subglobose berries, red at apex, paler near base, sometimes whitish to more or less translucent, 3–3.5 mm long; seeds 2, ca. 1.5 mm long. Figs. 113 and 117.

Anthurium madisonianum is endemic to western Panama in premontane and lower montane rain forest at 450 to 2,200 m.

It is a member of section *Semaeophyllium* and is recognized by its climbing habit, its deeply three-parted leaf blades with the lateral lobes moderately slender and projected noticeably toward the apex, and by its weakly stipitate, slender, tapered, magenta spadix. Also characteristic are its berries that are red at the apex and paler near the base.

The species is probably closest to *Anthurium furcatum* Sodiro from Ecuador, which has a reddish to violet purple spadix but *A. madisonianum* differs from that species in having a nearly sessile spadix and typically more slender lobes. In contrast *A. furcatum* has a spadix stipitate 5–15 mm (rarely to 5 mm in *A. madisonianum*).

Anthurium madisonianum is also similar to *A. cineraceum,* a species from eastern Panama and Colombia but that species has a green (or rarely yellow) spadix (red-violet or magenta in *A. madisonianum*), as well as leaves that lack a naked posterior rib and dry more greenish and less glossy with generally broader, less markedly falcate lobes.

The species is named in honor of Dr. Michael Madison whose efforts at revising the palmately divided *Anthurium* species are much appreciated.

CHIRIQUÍ: NE of Boquete, along Río Palo Alto, *Hammel 5668* (MO); Cerro Colorado, *Antonio 4868* (MO); Cerro Pata de Macho, *Croat 48566* (MO); Fortuna Dam site, *Kress et al. 82-1373* (MO), *Hammel 2122* (MO); road between Gualaca & Fortuna Dam site, *Antonio 4104* (MO), *Croat 48671* (MO), *49833* (F, K, MO, US), *49883* (MO, PMA, US), *50072* (MO, PMA).

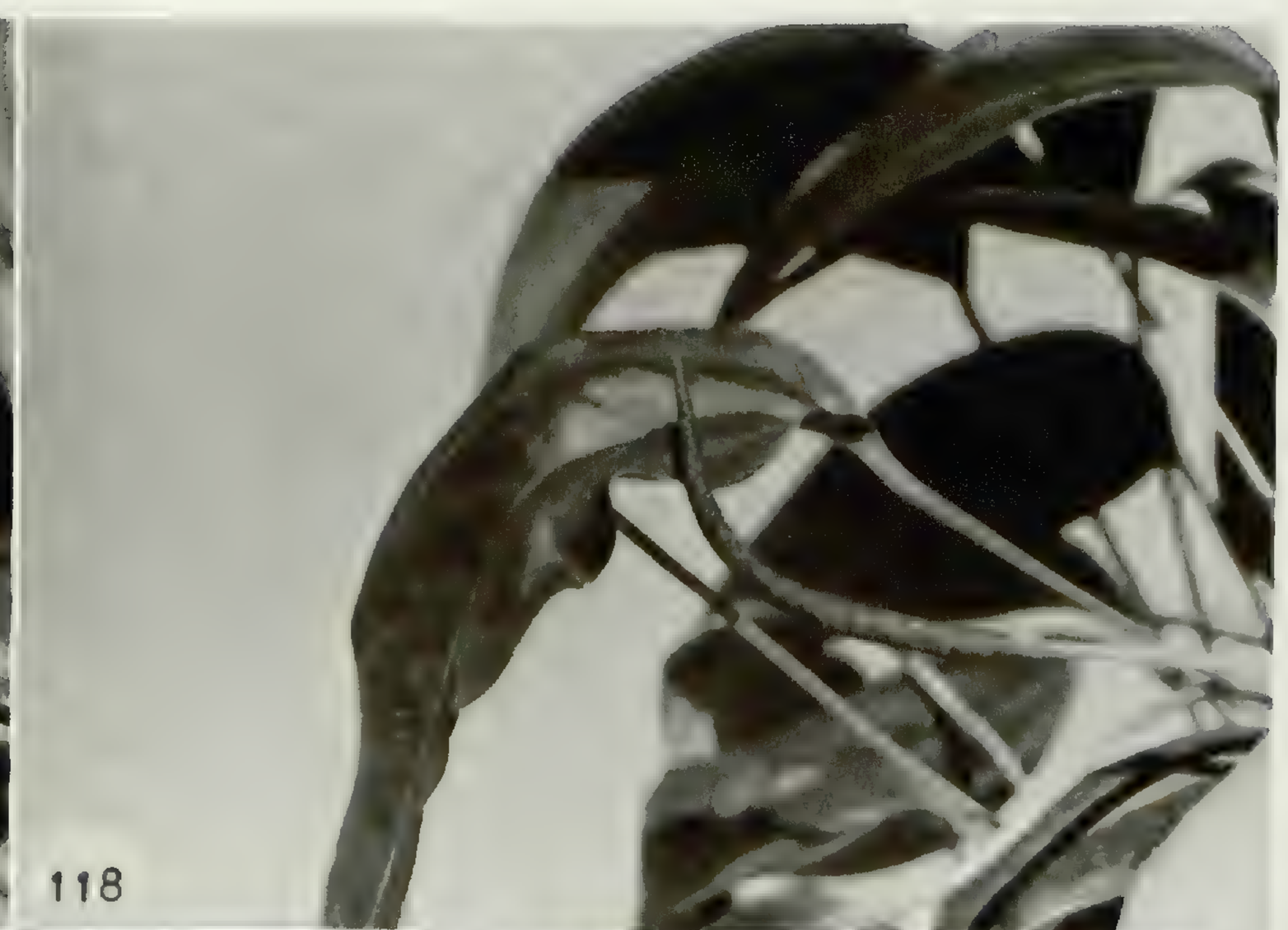
VERAGUAS: valley along Río Dos Bocas on road between Escuela Agricola Alto Piedra & Calovébora, *Croat 27599* (MO).

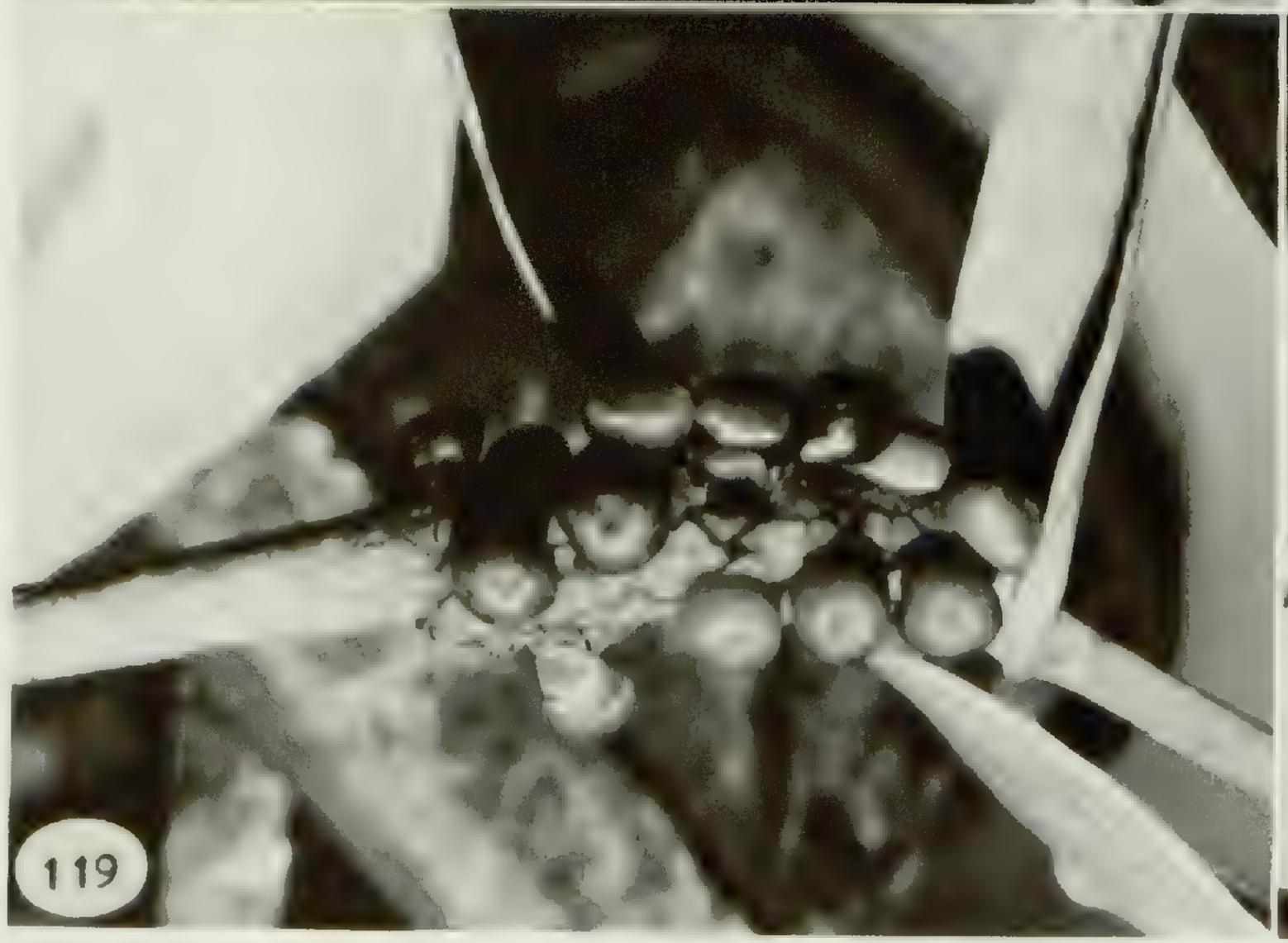
Anthurium malianum Croat, sp. nov. TYPE: Colombia. Chocó: Cerro Mali, on Panamanian border 1,200–1,400 m, lower montane wet forest, *Gentry & Mori 13818* (MO 2258221, holotype; PMA, isotype).

Planta epiphytica; cataphyllum modice membranaceum, sicce intactum, deciduum, paucarum fibrum persistens; petiolus 11–30 cm longus, sulcatus; lamina modice membranacea leviter bullata, ovato-triangulata ad sub trilobata, basi cordata, usque 32 cm longa, 6.7–22 cm lata; inflorescentia erecta; pedunculus teres, 16–22 cm longus; spatha modice membranacea, viridis ad viridis tincta subrosea, lanceolata, 6–11 cm longa; spadix sessilis, viridis ad luteus, 6–12 cm longus; baccae ignotae.

Epiphyte; stems 5–10 mm diam., internodes short (at least near apex); leaf scars inconspicuous; roots few; cataphylls moderately thin, 11–12.5 cm long, drying intact, faintly reddish brown, the bases of the fibers persisting. LEAVES with petioles 11–30 cm long, ca. 4 mm diam., sulcate adaxially; geniculum ca. 1 cm long; blades drying greenish, moderately thin, weakly bullate, ovate-triangular to narrowly triangular or sub-3-lobed, narrowly acuminate at apex (the acumen flat), prominently lobed at base, to 32 cm long, 6.7–22 cm wide, broadest at the base; anterior lobe 22–30 cm long, the margins slightly convex to concave; sinus arcuate with a decurrent petiole, broader than deep, ca. 3 cm deep; both surfaces drying conspicuously veiny, matte to semiglossy above, semiglossy below; midrib raised on both surfaces; basal veins 6 or 7 pairs, the uppermost free, the third and higher coalesced 1.5–2.5 cm, the posterior rib weakly curved, naked more than 1 cm; primary lateral veins ca. 15 per side, departing midrib at 40–50° angle, weakly arcuate to the collective vein; interprimary and secondary veins drying scarcely less prominent than the primary lateral veins; tertiary and reticulate veins drying prominulous below; collective veins arising from the lowermost basal veins, 1–6 mm from the margin. INFLORESCENCE erect, shorter than the leaves; peduncle 16–22 cm long, terete; spathe moderately thin, light green to pinkish green, lanceolate, 6–11 cm long, 1.2 cm wide, acuminate at apex, acute at the base, weakly decurrent, inserted at 45° angle on peduncle; spadix sessile, yellow to green, gradually tapered,

FIGURES 113–116. 113. *Anthurium madisonianum* Croat, *Croat 48671.*—114. *Anthurium oxystachyum* Croat, *Croat 44670.*—115. *Anthurium pauciflorum* Croat, *Folsom et al. 8145.*—116. *Anthurium pageanum* Croat, *Croat 44723.*





FIGURES 117–120. 117. *Anthurium madisonianum* Croat, *Croat 49883.*—118. *Anthurium oxystachyum* Croat, *Croat 44670.*—119. *Anthurium pageanum* Croat, *Page 82.*—120. *Anthurium pageanum* Croat, *Croat 44732.*

6–12 cm long, 3.5–5 mm diam. at the base, 2–2.5 mm diam. (dry) near the apex; flowers rhombic to sub-4-lobed, 1.8–2 mm long, about as broad as long, 6–11 flowers visible in the principal spiral; tepals weakly glossy, densely punctate, with raphide cells on drying, the lateral tepals 1–1.4 mm wide, the inner margin broadly rounded, the outer margin with the 2 sides convex; pistil not emergent; stamens weakly emergent, anthers 4–5 mm long, 5–6 mm wide; thecae ovate, moderately divergent. INFRUCTESCENCE not seen. Fig. 88; not type specimen as photo indicates.

Anthurium malianum is known only from two collections made on Cerro Mali at 1,200 to 1,400 m.

It is distinguished by its moderately thin, veiny, ovate-triangular to sub-three-lobed, bullate blade with numerous primary lateral veins and by the flowers with shield-shaped lateral tepals. It is perhaps best placed in section *Polyneurium* with relatives of *Anthurium argyrostachyum* Sodiro but is distinguished by its much smaller leaves. It could probably be confused with *A. caperatum,* another thin, veiny-bladed species from western Panama and Costa Rica, but the latter differs in having blades typically ovate and usually much larger and in having a more typically cylindroid spadix that is scarcely tapered toward the apex.

Anthurium malianum is also similar to *A. niqueanum* (from the nearby Serranía de Pirre), but the latter differs in having a thicker blade and in having elongate internodes. *Gentry & Mori 13705* differs from the type in having more flowers per spiral (nine to 11 versus five to six on the type).

DARIÉN/CHOCÓ (COLOMBIA): Cerro Mali, on border of Panama & Colombia, *Gentry & Mori 13705* (MO), *13818* (MO, PMA).

Anthurium melastomatis Croat, sp. nov. TYPE: Panama. Coclé: near Continental Divide above sawmill N of El Copé, 1,100 m, 8°41′N, 80°38′W, *Hammel 3471* (MO 2658953, holotype).

Planta terrestris aut epiphytica; internodis 2.5–4.5 cm longis, apice brevioribus; cataphyllum persistens reticulo fibrarum; petiolus subteres, anguste sulcatus, 9–22 cm longus; lamina subcoriacea, ovata ad anguste-ovata, basi obtusa rotundata aut attenuata, raro acuta aut subcordata (8.5–)12–22 cm longa, (4–)6.5–12.7 cm lata, utrinque dense glanduloso-punctata, paribus tribus venarum collectivarum; inflorescentia plus minusve erecta; pedunculus teres, 17–34 cm longus; spatha modice membranacea, viridis, lanceolato-oblongae, 2.5–7 cm longa, 6–17 mm lata; spadix viridis, purpureascens, 4.5–9.5 cm longus; baccae subroseae ad rubrae, obovoideae, ca. 5 mm longae.

Terrestrial or epiphytic, more or less erect; stems to ca. 1 m long, 8–12 mm diam.; internodes elongate, 2.5–4.5 cm long, in lower portion, often relatively short near the apex; leaf scars inconspicuous; roots relatively few, ca. 2 mm diam.; cataphylls 10–16 cm long, promptly weathering to a well-developed, persistent reticulum of brownish fibers. LEAVES usually persisting only at the upper nodes; petioles subterete, narrowly and obtusely sulcate, the sulcus sometimes broader with a medial groove, 9–22 cm long, 3–5 mm diam., three-fourths as long as or sometimes longer than the blade; geniculum 1–1.5 cm long; blades subcoriaceous, weakly arched along the midrib, ovate to narrowly ovate, acuminate at apex (the acumen apiculate), usually obtuse to rounded or subcordate at the base, (8.5–)12–22 cm long, (4–)6.5–12.7 cm wide, broadest below the middle; upper surface semiglossy, densely but inconspicuously dark glandular-punctate, the lower surface semiglossy, much paler, more densely and more conspicuously dark glandular-punctate; midrib raised on both surfaces, paler than the surface above; basal veins usually 3, free to the base, 2 of these extending in smooth curves to the apex (both acting as collective veins), the third usually joining the margin in the lower one-fourth to one-third, merely etched into the surface and scarcely or not at all more prominent than the primary lateral veins; primary lateral veins 8–10 per side, departing the midrib at 30–50° angle, mostly straight to the first collective vein, etched into surface, the lateral veins between the first and second collective veins directed at the same angle or often at a broader angle more nearly approaching 90° from the midrib; interprimary veins weaker than primary lateral veins on fresh leaves but equally as prominent as the primary lateral veins on dried plants. INFLORESCENCE more or less erect; peduncles 17–34 cm long, 2–3.5 mm diam., terete, usually considerably longer than the longest petiole; spathe moderately thin, green, the margins sometimes tinged with purple, lanceolate-oblong, 2.5–7 cm long, 6–17 mm wide, broadest in basal one-third, abruptly acuminate at apex, acute to obtuse at base, inserted at ca. 30° angle on peduncle; stipe 1–2 mm long, ca. 3 mm diam., fleshy; spadix green, becoming violet purple in age, slightly tapered and relatively blunt at apex, 4.5–9.5 cm long, 5–7 mm diam. at base, 3–4 mm diam near apex; flowers square, 2.1–3.6

mm wide in both directions, the sides straight to weakly sigmoid; 5–6 flowers visible in the principal spiral, 3–4 visible in alternate spiral; tepals semiglossy, sometimes tinged purple on inner margins; lateral tepals 1.4–2 mm wide, the inner margins broadly rounded, turned upward against the emerging pistil, the alternate pair with inner margins at least appearing concave; pistils green, weakly emergent; stigma oblong, brush-like, 0.3–0.5 mm long; stamens emerging in a regular sequence from the base, retracting completely after anthesis; anthers creamy white, ca. 0.2 mm long, ca. 0.4 mm wide; thecae oblong-elliptic, scarcely divaricate; pollen white. INFRUCTESCENCE semi-erect, the spadix turning violet purple, to 13 cm long; berries pinkish white to red, obovoid, ca. 5 mm long (boiled up), 4 mm wide, rounded at apex; seeds 2, ellipsoid, slightly flattened, obliquely sunken at apex around the funiculus, rounded at base, 2.5–3 cm long, 1.9–2.1 mm diam., 1–1.5 mm thick, tan, with a sticky, gelatinous, transparent appendage at apex. Figs. 121 and 122.

Anthurium melastomatis is endemic to Panama in Coclé and San Blas Provinces at 550 to 1,100 m in premontane and lower montane rain forest. Thus far the species has been collected at two rather widely separated localities on either side of the isthmus. The population on the South American side of the isthmus sometimes has blades subcordate at the base.

The species, a member of section *Porphyrochitonium,* is distinguished by its slender stem, its elongate internodes, its persistent, pale, netlike weathered cataphylls, its long-petiolate, more or less ovate, glandular-punctate leaf blades with three pairs of collective veins (two of which extend to the apex), its green spathe and spadix (the latter turning purple in age), and by its pinkish white to red berries.

Anthurium melastomatis is related to both *A. collinsii* and *A. subrotundum,* which both differ in having but a single collective vein.

The name refers to the type of leaf venation that is common in the family Melastomataceae.

COCLÉ: Alto Calvario, *Croat 49149* (MO), *Folsom & Collins 1544* (MO, SEL), *Folsom & Robinson 2411* (MO), *2428* (MO, PMA); vicinity El Copé, *Folsom 1210* (MO), *4141* (MO, TEX), *Folsom et al. 7101* (F, MO, NY, US), *Hammel 1023* (F, K, MO), *2410* (MO, PMA, US), *2636, 3471* (MO); vicinity El Potroso, *Sytsma 1783* (K, MO, PMA), *Sytsma & Andersson 4578* (MO).

SAN BLAS: Cerro Habú, *Sytsma et al. 2693, 2698* (MO), *2748* (MO, PMA).

Anthurium michelii Guillaumin, Bull. Mus. Hist. Nat. (Paris) 31: 263. 1925. TYPE: Panama. Bocas del Toro: hills beyond Fish Creek Lagoon, *Wedel 2276* (P, holotype).

Anthurium amethystinum Croat & Baker, Brenesia 16(Supl.): 20. 1979. TYPE: Costa Rica. Cartago: along road between Moravia (E of Tuis, SE of Turrialba) and Quebrada Platanillo, 3–5 km from Finca Racine in Moravia, 1,200–1,300 m, disturbed primary forest, *Croat 36601* (MO 2395446, holotype; CAS, CR, F, K, NY, SEL, US, VEN, isotypes; Live at MO).

Epiphytic or terrestrial; stem usually very short, 6–25 cm long, 1.5–3 cm diam.; cataphylls persisting, weathering into fibers; petioles 9–25(–40) cm long, 5–9 mm diam.; flattened laterally, sulcate with sharp margins, acute to rounded abaxially; blades elliptic to oblong-elliptic or oblong, acute to obtuse at base, 8–54 cm long, 5.5–22 cm wide. Inflorescence pendent or arching pendent; peduncle 30–58 cm long, 3–5 mm diam., prominently 4- or 5-ribbed especially near the base, irregularly striate toward apex with one prominent, sharp rib arising from beneath the spathe; spathe coriaceous, medium green, oblong-lanceolate to oblong, 3–15 cm long, 1–2.5 cm wide; stipe 0.8–3.5 cm long; spadix yellow-green, (4.5–)8.5–20 cm long, 6–10 mm diam. at base; berries dark purple to violet purple, obovoid to ovoid or pyramidal, pointed at apex, 7–12 mm long when dry; seeds 2. See Croat (1983: 323) for a more complete description.

The species is known from Costa Rica, Panama, and Colombia on both slopes at altitudes from 400 to 1,400 m, mostly in premontane wet and tropical wet forest.

Anthurium michelii is tentatively placed in section *Urospadix* and is distinguished by its creamy green or whitish lower leaf surface and bright purple berries. Also characteristic are the oblong-elliptic leaves, the broadly and sharply sulcate petiole, and the frequently conspicuously stipitate spadix. Though previously reported in section *Pachyneurium,* it was later observed to have supervolute leaf vernation instead of the typical involute vernation of section *Pachyneurium.*

Anthurium michelii is similar to *A. correae* with which it shares a similar inflorescence and

FIGURES 121–124. 121, 122. *Anthurium melastomatis* Croat, *Croat 44707*. —123, 124. *Anthurium nervatum* Croat, *Croat 27329*.

berries. It differs from the latter species in having larger leaves with more conspicuous tertiary venation.

BOCAS DEL TORO: along trail to Boquete, *Hammel 6179* (MO).

CHIRIQUÍ: Cerro Colorado, *Croat 33304* (DUKE, GH, MO, RSA), *37269* (MO), *Sullivan 406* (MO); W of El Hato del Volcán, *Maas & Dressler 4924* (MO); above San Félix, *Croat 33142* (B, C, F, MO, S, UC, US, VEN, W).

COCLÉ: Alto Calvario, *Croat 49165* (MO), *Folsom 2334, 3153, 3196* (MO); Cerro Pilón, *Mori 6554* (MO); vicinity El Copé, *Antonio 3256* (MO), *Hammel 3584, 4131* (MO); N of El Valle, *Allen 2954* (MO); road from Llano Grande to Cascajal, NW of Penonomé, *Sytsma 3890* (MO); past Llano Grande on road to Cascajal, *Sytsma et al. 4396* (MO); road between Llano Grande & Coclecito, *Croat 49223* (MO, PMA), *Hammel 1955* (MO).

COLÓN: Santa Rita Ridge, *Kennedy 2737* (K, MO, PMA, US), *Mori & Kallunki 5054* (MO), *Mori & Crosby 6344* (MO).

DARIÉN: Cuasí-Cana, *Davidson 1442* (F), *Kirkbride & Duke 1231, 1351* (MO).

PANAMÁ: El Llano-Cartí Road, *Croat 22862* (MO), *Folsom 2577* (MO), *Folsom & Dressler 5766* (MO), *Kennedy 2495* (MO), *Liesner 1123* (MO, PMA), *Mori & Kallunki 1867, 2905* (MO), *2286* (MO, PMA).

VERAGUAS: road between Agriculture School & Alto Piedra, *Croat 25953* (MO); mouth of Río Concepción, *Lewis et al. 2824* (MO), *Mori & Kallunki 3874* (MO).

Anthurium microspadix Schott, Oesterr. Bot. Z. 8: 180. 1858. TYPE: Costa Rica. Near Naranjo, *Oersted s.n.* (type not found; Photo of Schott Aroid Drawing #322, NYBG Neg. #N.S.3812).

Anthurium porrectum Schott, Oesterr. Bot. Z. 8: 180. 1858. TYPE: Costa Rica. Near Desengaño, *Wendland 841* (GOET).

Anthurium tapinostachyum Schott, Oesterr. Bot. Z. 8: 180. 1858. TYPE: Costa Rica. Near Candelaria, Alto de la Cruz, *Hoffmann s.n.* (Photo of Schott Aroid Drawing #331, NYBG Neg. #N.S.3818).

Anthurium colombianum Engl., Bot. Jahrb. Syst. 25: 379. 1898. TYPE: Colombia. Putomayo: valley of Sibundoy near Santiago, E of Pasto, 2,000–2,500 m, *Lehmann 546* (B, lectotype).

Anthurium tuerckheimii Engl., Bot. Jahrb. Syst. 25: 380. 1898. TYPE: Guatemala. Alta Verapaz: Panzamalá, 1,200 m, *Tuerckheim 864* (B, holotype; K, US, isotypes).

Anthurium gracilescens Sodiro, Anales Univ. Centr. Ecuador 15: 393. 1902. TYPE: Ecuador. Pichincha: Nanegal, *Sodiro s.n.* (B).

Anthurium lepturum Sodiro, Anales Univ. Centr. Ecuador 15: 458. 1902. TYPE: Ecuador. Pichincha: W slopes of Volcán Pichincha, *Sodiro s.n.* (B).

Anthurium nanegalense Sodiro, Anales Univ. Centr. Ecuador 15: 460. 1902. TYPE: Ecuador. Pichincha: Gualea, *Sodiro s.n.* (B).

Anthurium silvaticum Sodiro, Anales Univ. Centr. Ecuador 22: 25. 1907. TYPE: Ecuador. Tungurahua, *Sodiro s.n.* (B).

Anthurium barbanum K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 9: 270. 1925. TYPE: Costa Rica. Near Barba, *Brade 2510* (B).

Anthurium gracilens Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 68. 1940. TYPE: Panama. Chiriquí: Río Chiriquí Viejo Valley, 1,300–2,000 m, *White 160* (F, holotype; MO, isotype).

Scandent epiphyte or semierect, terrestrial herb; stems elongate, frequently to 1 m or more long, 4–7 mm diam.; cataphylls promptly weathering, soon deciduous, sometimes with a few pale fibers persisting; petioles subterete, narrowly and shallowly sulcate, 5–16(–24) cm long, 2–2.3 mm diam.; blades moderately thick, usually more or less oblong, sometimes lanceolate, narrowly oblong-elliptic or oblong-ovate, usually truncate to rounded at base, sometimes acute or subcordate, 9–25 cm long, 2.5–11 cm wide. Inflorescence erect; peduncle terete, 5–15 cm long; spathe lanceolate-elliptic, olive green or pale green, sometimes tinged purplish, 3–4(–5) cm long, to 1.7 cm wide; stipe usually 2–5 mm long, sometimes absent, or to 10 mm long; spadix pale yellow to yellow-green or green, sometimes tinged with purple, 1.5–4 cm long at anthesis, usually 4–5 mm diam. near base; berries yellowish green, subglobose, ca. 5 mm diam. See Croat (1983: 325) for a more complete description.

The species ranges from Mexico to Ecuador at elevations from 800 to 2,300 m in premontane rain, lower montane wet, and lower montane rain forest. It is one of the most variable species of *Anthurium* in North America. In Panama it is most easily confused with *A. pallens.* [See that species in Part I (Croat, 1983) for a discussion of the differences.]

Anthurium microspadix has been placed in section *Xialophyllium,* and in South America it is apparently closely related to *A. amoenum* Kunth in Peru and Bolivia and to *A. tenuicaule* Engl. and *A. brachypodum* Sodiro from Ecuador.

CHIRIQUÍ: no other location, *Duke et al. 13649* (DUKE, MO), *Luteyn 17283* (DUKE); Bajo Chorro, *D'Arcy 10916* (MO), *Davidson 41* (MO); Bajo Grande, *Wilbur et al. 15175* (DUKE); vicinity Bajo Mono, *Folsom et al. 2257* (MO), *Woodson & Schery 549* (MO), *Woodson et al. 1026* (MO); between Bambito & Cerro Punta, *Croat 10558, 10578* (MO, NY); vicinity Boquete, *Croat 15780* (MO), *Cochrane et al. 6312* (MO, WIS), *Hammel 5718* (MO), *Maxon 5707* (NY), *Stern et al. 1051* (MO); Cerro Colorado, *Antonio 4905* (MO), *Croat 33364* (MO), *Sullivan 377* (MO); Cerro Horqueta, *Luteyn 3783* (DUKE, MO); Cerro Pando, *Knapp*

1678 (MO), *Mori & Bolten 7272* (MO); Cerro Pata de Macho, *Croat 48552* (MO), *Sytsma et al. 4896* (DUKE, K, MO); vicinity Cerro Punta, *Allen 1531* (MO), *Busey 663* (MO), *Croat 48569* (MO), *Folsom 6013* (MO), *Hammel 1426* (MO), *Maas & Dressler 4874* (MO), *McDaniel 10163* (MO), *Stevens 18193* (MO); Fortuna Dam site, *Correa et al. 2238, 2692* (MO); vicinity Gualaca, *Antonio 5138* (MO); road between Gualaca & Fortuna Dam site, *Antonio 4115* (MO), *Croat 48663, 48806, 49889* (MO); Las Nubes, *Croat 26489* (MO), *Luteyn 4650* (DUKE), *Wilbur 15233* (DUKE, MO); vicinity Monte Lirio, *Seibert 146, 219* (MO); between Quebrada Hondo & Continental Divide on Caldera-Chiriquicito Trail, *Kirkbride & Duke 940* (MO); vicinity Río Chiriquí Viejo, *Hammel et al. 6858* (MO), *White 160* (MO), *Wilbur 13096* (DUKE), *Wilbur et al. 15372* (DUKE); above San Félix, *Croat 33067* (MO), *33448* (MO, PMA, US); road from Volcán to Río Sereno, *Folsom 4057* (MO).

VERAGUAS: vicinity Santa Fe, *Mori & Kallunki 2522* (MO), *Nee 11208* (MO); above Río Primero Brazo, NW of Santa Fe, *Croat 23236* (MO).

Anthurium myosuroides (H.B.K.) Endl., Gen. Pl. 3: 240. 1837. *Pothos myosuroides* H.B.K., Nov. Gen. Sp. Pl. 1: 75. 1815. TYPE: New Granada. Quindio: between El Moral and Paso del Machin, *Bonpland s.n.* (P).

Pothos microstachyus H.B.K., Nov. Gen. Sp. Pl. 1: 75. 1815. *Anthurium microstachyum* (H.B.K.) Kunth, Enum. Pl. 3: 72. 1841. TYPE: New Granada. Quindio: between El Moral and Paso del Machin *Goudot s.n.* (P).

Epiphyte, scandent; stems elongate, moderately thin; internodes 4.5–5.5 cm long; cataphylls 7–10 cm long, drying brown, persisting at upper nodes. LEAVES erect to spreading; petioles 4–13 cm long, weakly sulcate; blades subcoriaceous to moderately thin, usually elliptic, sometimes more or less ovate, 17–21 cm long, 6–10 cm wide, broadest at middle or just below; anterior lobe 15–19 cm long, the margins convex; posterior lobes 1.5–3.5 cm long, from apex of sinus to outermost point; sinus parabolic to weakly hippocrepiform, the apex rounded; both surfaces matte on drying; midrib prominulous above, more prominently raised below (dry); basal veins 3–4 pairs, free to the base, prominulous above, raised below, yellow (dry); primary lateral veins 6–7 per side, departing the midrib at 40–45° angle, straight to collective vein, prominulous above, raised below (dry); lesser veins visible on both surfaces (dry); collective vein arising from the first basal vein, loop-connecting the primary lateral veins, 5–7 mm from margin. INFLORESCENCE erect-spreading (?); peduncle 10–16 cm long, ca. 2 mm diam.; spathe moderately thin, green, lanceolate, 4–6 cm long, ca. 0.9 cm wide, acuminate at apex, acute to more or less rounded at base; spadix stipitate to 1.5 cm, yellow, 6–9 cm long, 5–6 mm diam. near base, 3–4 mm diam. near apex; flowers rhombic, 2.7–3 mm long, 2.2–2.5 mm wide (dry); the sides sigmoid, 3–5 flowers visible in the principal spiral, 5–6 flowers visible in the alternate spiral; lateral tepals 0.6–0.7 mm wide, the inner margins convex; pistils scarcely emergent; stigmas inconspicuous; stamens emerging in a regular sequence throughout the length; anthers held at sides of pistil; thecae ovate, weakly divaricate. INFRUCTESCENCE not seen. Fig. 98.

Anthurium myosuroides ranges from Panama to Colombia and perhaps also to Ecuador at 700 to 2,000 m. In Panama the species is apparently rare, occurring only in tropical wet forest at 700 to 850 m.

The species is a member of section *Xialophyllium* and is distinguished by its slender stems with elongate internodes, its thin, veiny, oblong-ovate leaf blades that are narrowly subcordate at the base and broadest in the middle, its long-pedunculate, yellowish to orange spadix, and by its green oblong-lanceolate spathe.

The species can be easily confused with *Anthurium microspadix,* but in Panama that species is restricted to Chiriquí Province and differs in having the blades widest in the lower one-third or at the base, whereas the blades of *A. myosuroides* are broadest near the middle.

Anthurium myosuroides was long confused with *A. flexile* ssp. *flexile,* and Engler even described *A. myosuroides* var. *angustifolium,* which is now considered synonymous with *A. flexile.* The two species are, however, not related. *Anthurium flexile,* a member of section *Polyphyllium,* has a wiry stem with many roots in between the internodes. *Anthurium myosuroides* has a much thicker stem with roots restricted to the internodes.

Engler's drawing number 370 labeled *Anthurium microspadix* is actually *A. myosuroides.* See Fig. 98.

CANAL ZONE: Barro Colorado Island, *Foster 1955* (DUKE).

COCLÉ: vicinity La Mesa, *Luteyn 3181* (DUKE, MO).

PANAMÁ: NE of Altos de Pacora, *Mori & Kallunki 6038* (MO); Capira, *Foster 2102* (DUKE).

Anthurium nervatum Croat, sp. nov. TYPE: Panama. Veraguas: valley of Río Tercero Braso, beyond Escuela Agricola Alto Piedra above

Santa Fe, primary forest along road, 500–700 m, *Croat 27329* (MO 2253314, holotype; F, K, PMA, US, isotypes; Live at MO).

Planta epiphytica; ca. 1 m alta; cataphyllum coriaceum persistens intactum, ultimo deciduum; petiolus quadrangulatus; leviter sulcatus to complanatus adaxialle, 34–74 cm longus; lamina triangulata ad ovato-triangulata, modice coriacea, basi cordata ad subcordata, 46–98 cm longa, 14.5–46 cm lata, nervis primariis lateralis 19–25; inflorescentia effusa; pedunculus 10–35 cm longus, teres; spatha coriacea, pagina interiora purpurea, pagina exteriora viridis, lanceolata, 10–33 cm longa, 2.5–5.5 cm lata, leviter circinata; spadix viridis, lanceolata, 10–33 cm longa, 2.5–5.5 cm lata, leviter circinata; spadix viridis ad violaceo-purpureus, (6–)18–28 cm longus; baccae aurantiacae, oblongo-ellipticae.

Epiphyte, ca. 1 m tall; stem more than 10 cm long, 4–6 cm diam.; internodes short; leaf scars conspicuous; roots thick, numerous, green, descending; cataphylls coriaceous, 16–32 cm long, rounded to emarginate at apex with subapical apiculum ca. 5 mm long, drying tan (B & K Yellow-red 9/10), persisting intact, ultimately deciduous. LEAVES erect to spreading; petioles bluntly to sharply quadrangular, weakly sulcate to flat adaxially, sometimes 1-ribbed abaxially, 34–74 cm long, 0.7–1 cm wide; geniculum 3–5 cm long, sometimes more conspicuously sulcate than petiole; blades triangular to ovate-triangular, moderately coriaceous, gradually acuminate at apex, shallowly lobed to subcordate at base, 46–98 cm long, 14.5–46 cm wide, broadest in the lower one-fourth of blade; anterior lobe 27–90 cm long, the margins more or less straight to convex; posterior lobes (7–)9–19 cm long (from apex of sinus to outermost point), the outer margin turned up; sinus arcuate to arcuate with petiole decurrent, weakly rounded at apex; upper surface matte to semiglossy, lower surface only slightly paler, semiglossy; midrib flat at base above with an acute medial rib, more acutely raised from about midway to the apex, convexly raised below, conspicuously paler than surface; basal veins 3–5 pairs, often free to the base, the second to fifth sometimes coalesced 1.5–2 cm; primary lateral veins 19–25 per side, departing the midrib at a 50–60° angle, straight to collective vein or weakly arching, prominently raised above, raised below, conspicuously paler than surface above, lesser veins obscure above, visible and flat below; collective vein arising from the first or second basal vein or one of the lowermost primary lateral veins, 1–5 mm from the margin, loop-connecting the primary lateral veins, sunken above. INFLORESCENCE spreading, shorter than leaves; peduncle 10–35 cm long, 8–10 mm diam., terete, one-half to two-thirds as long as petiole; spathe coriaceous, maroon (B & K Red-purple 2/10) on inner surface, green tinged maroon on outer surface, lanceolate, 10–33 cm long, 2.5–5.5 cm wide, broadest just above point of attachment, reflexed at anthesis and sometimes weakly coiled, long-acuminate and inrolled at apex, rounded to cordate at base, inserted at a 30° angle on peduncle; spadix green to maroon (B & K Red-purple 2/5), tapered toward apex, (6–)18–28 cm long, 1–2 cm diam. at base, 0.8–1 cm diam. at apex; flowers weakly 4-lobed, 2.7–3.2 mm long, 2.9–3.1 mm wide, the sides weakly to jaggedly sigmoid, 13–15 flowers visible in the principal spiral, 12–20 flowers visible in the alternate spiral; tepals matte, conspicuously punctate, minutely papillate, the lateral tepals 0.8–1 mm wide, the inner margins concave to straight; pistils emergent, green tinged violet purple; stigmas linear, violet purple, 0.6–1 mm long; stamens emerging from the base, the laterals first, quickly followed by alternates, stamens exserted on red-violet filaments 1.4–1.6 mm long, which dry to hold anthers above and slightly over or at sides of pistil; anthers ca. 0.7 mm long, ca. 0.9 mm wide; thecae ovate-oblong, weakly to not at all divaricate; pollen orange, fading to tan. INFRUCTESCENCE spreading to pendent; spadix to 45 cm long; berries orange, early emergent, oblong-elliptic, acute at apex, the tip relatively blunt; mesocarp with linear to punctiform raphide cells; seeds 2, oblong-ellipsoid to ellipsoid, somewhat flattened at least on one side, 4.5–5 mm long, 2.7–3.2 mm wide, 1–1.5 mm thick, rounded to obtuse at base, rounded to emarginate at apex with the radicle protruding; the appendage thin, at apex only (dried berries only were studied). Figs. 123 and 124.

Anthurium nervatum is endemic to Panama in Coclé, Chiriquí, and Veraguas Provinces at 500 to 1,500 m in tropical wet, premontane rain, and lower montane wet forest life zones.

The species is a member of section *Pachyneurium* and is recognized by its long, triangular, shallowly lobed to subcordate, moderately thick leaf blades with numerous primary lateral veins, its usually long-tapered green to maroon spadix, and by its lanceolate, coriaceous spathe that is deep maroon on the inner surface, green heavily tinged maroon on the outer surface, and often forms a loose spiral at anthesis. The name refers to the prominent primary lateral veins.

It is most easily confused with *Anthurium ranchoanum* but that species has a shorter spadix with an erect, green spathe and larger flowers with fewer per spiral. It may also be confused with *A. colonicum* but the species has early exserted, acute pistils and fewer primary lateral veins in the blade.

One collection from El Valle in Coclé Province (*Croat 37443*) is probably also this species, but it has a smaller, more ovate-triangular, more coriaceous blade with the posterior lobes sharply turned upward and a deeper sinus; it also has a green rather than maroon spadix.

CHIRIQUÍ: Cerro Colorado, *Croat 33305, 37177, 48459* (MO), *33145* (DUKE, F, MO), *33394* (MO, RSA, US), *37169* (MO, PMA), *Folsom et al. 4706* (MO).

COCLÉ: Alto Calvario, *Croat 49169* (MO), *Folsom & Jaslon 2691* (MO); Cerro Caracoral, *Duke & Dwyer 15118* (NY), *Kirkbride 1096* (MO, NY); vicinity El Copé, *Croat 44717* (MO), *Hammel 2408* (MO); La Mesa, *Croat 37443* (MO, PMA, US).

VERAGUAS: above Santa Fe, *Croat 27329* (F, K, MO, PMA, US), *33987* (MO, US), *34244* (MO, PMA), *48912* (MO), *Croat & Folsom 34134* (MO); slopes of Cerro Tute, *Croat 48925* (MO).

Anthurium niqueanum Croat, sp. nov. TYPE:
Panama. Darién: Serranía de Pirre, 9–10 km due N of Alturas de Nique, lower montane rain forest, 1,520–1,560 m, *Croat 37875* (MO 2416615, holotype).

Planta repens epiphytica, internodis usque 7 cm longis; cataphyllum subcoriaceum, deciduum; petiolus sulcatus, 22–35 cm longus; lamina subcoriacea bullata, ovata ad anguste triangulata, basi leviter ad profunde cordata, 22.5–39(–46) cm longa, 9–14.5(–17.5) cm lata; inflorescentia erecta(?); pedunculus 13–21(–28) cm longus; spatha viridis, modice membranacea, anguste lanceolata, 3–5(–11) cm longa, ca. 6(–8) mm lata; spadix stipite usque 6 mm longo, viridis; baccae ignotae.

Epiphytic creeper; stem elongate ca. 5 mm diam.; internodes elongate to 7 cm; cataphylls subcoriaceous, 7–15 cm long, drying tan, early deciduous. LEAVES erect-spreading; petiole sulcate, 22–35 cm long, one-half as long to slightly longer than the blade; geniculum sharply sulcate, ca. 1.5 cm long; blades (dried) subcoriaceous, conspicuously bullate, ovate to narrowly triangular, abruptly acuminate to long-acuminate at apex, shallowly to deeply lobed at base, 22.5–39(–46) cm long, 9–14(–17.5) cm wide, broadest from midway to point of petiole attachment (rarely broadest at base); anterior lobe 18.5–32(–36.5) cm long, the margins usually convex (sometimes more or less straight to concave), posterior lobes 4.5–9(–10) cm long, from apex of sinus to outermost point; sinus parabolic to hippocrepiform, rounded at apex; upper surface weakly glossy, both surfaces drying matte, the lower surface paler; midrib raised above and below, drying yellow below; basal veins 3–5(–6) pairs, the first and second free, those remaining coalesced to 1 cm forming a weak posterior rib; primary lateral veins 11–13 per side, departing midrib at (55–)65–70° angle, arching to collective vein, prominulous above, more prominent below; lesser veins scarcely visible above, conspicuous below; collective vein arising from one of the lowermost basal veins, loop-connecting the primary lateral veins, 3–4 mm from the margin, prominulous above, more prominent below. INFLORESCENCE (dried) erect (?); peduncle 13–21(–28) cm long; spathe green, moderately thin, narrowly lanceolate, 3–5(–11) cm long, ca. 6(–8) mm wide, broadest near base; spadix sessile or stipitate to 6 mm; green, slightly tapered, 4–7 cm long, 3–5 mm diam. near base, 2–4 mm diam. near apex, flowers rhombic, 1.9–2 mm long, 1.4–1.5 mm wide, ca. 5 flowers visible in the principal spiral, 9–10 flowers visible in the alternate spiral; tepals matte, lateral tepals ca. 1 mm wide, the inner margin broadly rounded; pistils not emergent; stamens held just above tepals; anthers ca. 0.4 mm long, ca. 0.6 mm wide; thecae ovoid, slightly divaricate. INFRUCTESCENCE to 20 cm long, peduncle to 27 cm long; mature berries not seen. Fig. 85.

Anthurium niqueanum is known only from Panama in the Serranía de Pirre, north of Alturas de Nique in lower montane rain forest at 1,200 to 1,560 m. It is probably to be found in adjacent areas of Colombia also.

The species is a member of section *Polyneurium,* but has no known close relatives.

It is distinguished by elongate internodes and somewhat bullate, triangular to ovate-triangular blades with prominent veins on the lower surface when dry. One specimen (*Folsom 4303*) has a much more narrowly triangular blade with an extremely large infructescence and is described as having the stem, petiole, and peduncle covered with a waxy substance.

DARIÉN: vicinity Alturas de Nique, *Croat 37875, 37904* (MO), *Hartman 12425* (MO, PMA); Cerro Pirre, *Folsom 4303* (MO); Cuasí-Cana Trail, between Cerro Campamento & La Escalera, *Kirkbride & Duke 1272* (MO).

Anthurium obtusilobum Schott, Oesterr. Bot. Z. 8: 181. 1858. TYPE: Costa Rica. Near San Miguel, *Wendland 777* (GOET, holotype; W, isotype).

Epiphytic or terrestrial; stems ca. 1.5 cm thick, to 30 cm long; cataphylls drying tan, persisting intact; petioles subterete, obscurely sulcate, 19–60 cm long, 6–9 mm diam.; blades ovate, moderately thick, 15–46 cm long, 9.5–28 cm wide, deeply lobed at base. Inflorescence spreading; peduncle (7–)15–43 cm long; spathe oblong-elliptic, pale green to white, 7–11.5 cm long, 2.3–2.7 cm wide; spadix cream to pale yellow-green, turning dark lavender to violet purple; 4.5–7.6 cm long, 8–11 mm diam. at base; berries red-violet, ovate, acute at apex; seeds not seen. See Croat (1983: 333) for a more complete description.

Anthurium obtusilobum ranges from Costa Rica to Colombia (Chocó) at elevations of 600 to 1,550 m in premontane wet, tropical wet, premontane rain, and lower montane wet forest.

The species is in section *Calomystrium* and is closest to *Anthurium hoffmannii* sharing with that species thick, persistent, reddish brown, entire cataphylls and a similar inflorescence. It is readily separated from other members of the section by having the collective vein arising from one of the lowermost basal veins and continuing to the apex close to the margin.

BOCAS DEL TORO: On Cerro Banyic, *Kirkbride & Duke 594* (MO).

CHIRIQUÍ: Fortuna Dam site, *Folsom et al. 8154, 8197* (MO), *Hammel 2072* (MO); road between Gualaca & Fortuna Dam site, *Antonio 4155* (MO), *Croat 48708, 48714, 50075* (MO), *49997* (K, MO), *50019* (MO, SEL, US); vicinity Gualaca, *Antonio 5023A* (MO); N of Hornito on road to La Fortuna, *Hammel 6244* (MO).

DARIÉN: Cerro Mali, *Mori & Gentry 4332* (MO, PMA); Cerro Tacarcuna, *Gentry & Mori 13926, 14100* (MO); vicinity mining camp of Tyler Kittredge, *Croat 27192* (MO).

Anthurium ochranthum C. Koch, Ind. Sem. Hort. Berol., App. 6. 1853. TYPE: Costa Rica, *Wendland s.n.* (P, hololectotype; B, BP, LE, W, isolectotypes; designated by Croat & Baker, 1979).

Anthurium lapathifolium Schott, Oesterr. Bot. Wochenbl. 7: 309. 1857. TYPE: Panama, *Fendler 429* (K).

Anthurium triangulum Engl., Bot. Jahrb. Syst. 25: 383. 1898. TYPE: Costa Rica. Limón: Talamanca, in forest near Shirores, 100 m, *Pittier & Tonduz 9225* (B).

Anthurium tsakianum Engl., Bot. Jahrb. Syst. 25: 423. 1898. TYPE: Costa Rica. Talamanca: in forest near Tsakí, 200 m, *Tonduz 9510* (B, holotype; CR, isotype).

Anthurium baileyi Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 66. 1940. TYPE: Panama. Canal Zone: Barro Colorado Island, *Bailey & Bailey 196* (F, holotype).

Terrestrial, rarely more than 1.5 m tall; stem to 45 cm long, 2–4 cm diam.; cataphylls drying brown, weathering to coarse linear fibers; petioles terete or obscurely sulcate, 30–70(–90) cm long, to 0.5 cm diam.; blades ovate-triangular, moderately thin, 39–75 cm long, 18–48 cm wide, deeply lobed at base. Inflorescence erect; peduncles 24–63 cm long; spathe green or pale green, sometimes tinged with red-violet, lanceolate, 10–15(–32) cm long, 3–5 cm wide; spadix green turning bright yellow, 7–22 cm long; berries violet purple at apex, white at base, obovoid, 7–9 mm long. See Croat (1983: 335) for a more complete description.

Anthurium ochranthum is known from Costa Rica to Panama from sea level to 1,350 m, most commonly in tropical wet forest but also in wetter parts of tropical moist forest and in premontane wet and premontane rain forest.

Anthurium ochranthum is placed in section *Belolonchium* and is recognized by its terrestrial habit, its bright yellow, long-tapered spadix, its violet purple and white berries, and by its leaf blades that have the anterior lobe sometimes concave along the margins. It is most closely related to *A. pluricostatum*.

BOCAS DEL TORO: Almirante, *Kennedy 1269* (DUKE), *3230* (AAU, MO); Chiriquicito, S of Río Guarumo, *Lewis et al. 2052* (MO); vicinity Chiriquí Lagoon, *Wedel 2720* (MO); Río San Pedrito, *Gordon 40C* (MO); Water Valley, *Wedel 671, 766* (MO); Zigla Road near junction Chanquinola & Teribe Rivers, *Lazor et al. 2583* (MO).

CANAL ZONE: Barro Colorado Island, *Aviles 12, 17* (MO), *Bailey & Bailey 197* (BH), *Bartlett & Lasser 16718* (MICH, MO), *Croat 4569, 4573, 4594, 5110, 5182, 5820, 6014, 6019, 6415, 8464, 9309, 10175, 10219, 11486, 11742, 11751, 11752, 15104, 34372* (MO), *Foster 2032* (DUKE), *Stoutamire 2056* (MICH); N of Escobal, *Croat 12490* (MO); Fort Sherman, *Porter et al. 4987* (MO), *Tyson & Dwyer 1214* (MO); vicinity Gamboa, *Clewell & Tyson 3288* (MO), *Nee 9450* (MO); near Gatún, *Hayes s.n.* (NY); vicinity Piña, *Gentry 8633* (MO), *Kennedy 1077* (DUKE, MO), *Liesner 1385* (MO); along Río Indio de Gatún, *Pittier 2795* (US).

CHIRIQUÍ: vicinity Puerto Armuelles, *Croat 22103* (MO), *21949* (F, MO).

COCLÉ: Alto Calvario, *Folsom 3409* (MO); vicinity El Copé, *Hammel 793, 2351* (MO); El Valle de Antón, *Luteyn & Kennedy 1666* (DUKE); road past Furlong's Finca, N of Cerro Pilón, *Croat 37556* (MO, PMA); La Mesa, *Croat 25320* (MO), *Kennedy 3007* (MO), *Luteyn 3182* (DUKE); road from Llano Grande to Coclecito, *Croat 49231* (MO), *Hammel 1921* (MO).

COLÓN: Coclé del Norte, *Hammel 4507* (MO); SW of Colón, *Croat 14164* (MO); Isla Colón, *Wedel 122* (MO); vicinity María Chiquita, *Croat 11352* (MO), *Dwyer 3145* (MO); vicinity Piña, *Allen 3634* (MO), *Luteyn 1286* (DUKE); between Palma Bellas & Salud, *Croat 36881* (MO); vicinity Portobelo, *Croat & Porter 15593* (MO), *D'Arcy & D'Arcy 6679, 6704* (MO), *Foster 2063* (DUKE), *Kennedy 469* (DUKE); N from Río Escandaloso towards Cerro Bruja, *Hammel 2701* (MO); vicinity Río Guanche, *Antonio 1239, 4783* (MO), *Croat 36943A* (MO), *Davidse & D'Arcy 10065* (MO), *Nee 7089* (MO), *Sytsma 1668* (MO); vicinity Río Indio Road from Portobelo to Nombre de Dios, *Croat 33569* (B, CAS, MO, US); vicinity Río Piedras on road to Portobelo, *Blum et al. 2499* (MO); vicinity San Miguel de la Borda, *Croat 9883* (MO, SCZ), *10029, 36928* (MO); Santa Rita Trail, *Cowell 123* (NY); vicinity Fort San Lorenz, *Antonio 1938* (MO).

DARIÉN: vicinity Airstrip at Cana gold mine, *Croat 37954* (MO); E slope of Cerro Sapo, *Hammel 1254* (MO); Cerro Pirre, *Folsom & Mauseth 8512* (MO); vicinity Jaqué, below mouth of Río Pavarandó, *D'Arcy & Sytsma 14483, 14495* (MO), *Sytsma & D'Arcy 3324, 3377, 3379* (MO); trail from Río Pucro to Quebrada Maskia, *Duke 13077* (MO, OS); Manané to mouth of Río Cuasí, *Kirkbride & Bristan 1509* (MO); Río Pirre, up river from house of Bartolo, *Kennedy 2891* (MO, NY); vicinity Tyler Kittredge gold mining camp, *Croat 27098* (F, MO); vicinity Yaviza, *Allen 4590* (MO), *Duke 5015, 5167* (MO).

PANAMÁ: near summit of Cerro Campana, *Stimson 5417* (SCZ); El Llano-Cartí Road, *Folsom et al. 1473* (MO), *Hammel 7332* (MO), *Sytsma & Andersson 4450* (K, MO); Río Bayano, above Piría, *Duke 14401* (US); vicinity Serranía de Maje, *Folsom & Collins 1719* (MO), *Folsom & Lantz 1914* (MO); upstream from Tortí Arriba, *Folsom et al. 6832* (MO).

SAN BLAS: El Llano-Cartí Road, *Sytsma & Andersson 4518* (MO); vicinity Ailigandí, *D'Arcy & Hammel 12245* (MO), *Lewis et al. 152* (GH, MO); mainland opposite Playón Chico, *Gentry 6390* (MO).

VERAGUAS: beyond Escuela Agricola Alto Piedra, NW of Santa Fe, *Croat 49041* (MO), *48890* (FTG, MO); on road to Río Calovébora, *Croat & Folsom 33965, 34135* (MO).

Anthurium oxystachyum Croat, sp. nov. TYPE: Coclé. On the Atlantic slope near the Continental Divide along lumbering road above El Copé, 9.4 km, N of El Copé (2.2 km N of lumber sawmill), 8°37′N, 80°36′W, *Croat 44670* (MO 2909689, holotype; PMA, isotype; Live at MO).

Planta epiphytica; cataphyllum membranaceum, persistens intactum; petiolus teres, 11–20 cm longus; lamina subcoriacea, lanceolata, 9–17 cm longa, basi obtusa ad subrotundata, pagina inferiore glanduloso-punctata; inflorescentia effusa; pedunculus teres, 15–28 cm longus; spatha modice membranacea, viridis, lanceolata; spadix olivaceus, interdum suffusus purpureus, 4–7.5 cm longus; baccae aurantiacae, depresso-globosae, ca. 4 mm longae, seminibus 1–4.

Epiphyte; stems green, less than 10 cm long, 1 cm diam.; leaf scars moderately conspicuous, ca. 5 mm wide; roots spreading, short, green to purplish brown in age; cataphylls thin, 2–2.5 cm long, acuminate at apex, drying tan, weathering and persisting more or less intact, deciduous at lower nodes. LEAVES spreading; petioles terete, 11–20 cm long, 2–3 mm diam.; geniculum 1–1.5 cm long, scarcely thicker or paler than petioles; blades lanceolate, subcoriaceous, gradually to abruptly acuminate at apex (the acumen apiculate), obtuse to subrounded at base, 9–17 cm long, 2.7–6.3 cm wide, usually broadest in the lower third; both surfaces semiglossy, the upper surface eglandular, the epidermal cells convex, the lower surface dark glandular-punctate; midrib raised at base above, sunken at apex, raised below; primary lateral veins 4–5 per side, departing midrib at ca. 45° angle, straight to collective vein, scarcely sunken above, prominulous below, lesser veins scarcely visible above and below; collective vein arising from the base, 4–6 mm from margin. INFLORESCENCE spreading, as long as or longer than leaves; peduncle terete, 15–28 cm long, 1.5–2.5 mm diam., equalling or up to one and a half times longer than petioles; spathe moderately thin, medium green, lanceolate, 3–3.5 cm long, 7–8 mm wide, broadest just above base, acuminate at apex, rounded at base, the margins turned up, inserted at 90° angle on peduncle; stipe ca. 3 mm long in front, ca. 2 mm long in back, ca. 2.5 mm diam.; spadix olive green (B & K Yellow-green 5/5–5/7.5), sometimes becoming tinged with violet purple, 4–7.5 cm long, 4.5–5 mm near base, tapered to less than 1 mm at apex; the flowers square, 4–4.7 mm in both directions, the sides straight parallel to the spirals, weakly sigmoid perpendicular to the spirals, 2–3 flowers visible in the principal spiral, 5–6 flowers visible in the alternate spiral; tepals semiglossy, lateral tepals 2.7–3.2 mm wide, the inner margin more or less straight; pistils emergent, weakly raised, green; stigmas slit-like with minute exserted papillae; stamens emerging promptly from base, laterals emerging first at least to middle before alternates emerge, retracting promptly, usually with no more than one stamen visible per flower at any time; anthers

pale green, ca. 0.5 mm long, ca. 1 mm wide; thecae broadly ovoid, widely divaricate; pollen white. INFRUCTESCENCE to 11 cm long; berries orange, depressed-globose, ca. 4 mm long, 5 mm diam.; seeds usually 4, 2–2.5 mm long, 1–1.2 mm diam., weakly flattened. Figs. 114 and 118.

Anthurium oxystachyum is endemic to Coclé Province in Panama at about 900 m in premontane rain forest.

The species is in section *Porphyrochitonium* and is distinguished by its more or less lanceolate leaf blades that are mostly obtuse to subrounded at the base and are glandular-punctate on the lower surface and especially by its slender, sharply tapered, green spadix. The name refers to the sharply tapered spadix ("oxys" from the Greek for sharp).

It is most similar to and perhaps inseparable from *Anthurium crassiradix,* which has a similar sharply tapered spadix and flowers, but the latter species has thicker blades with the veins etched on the upper surface and is more conspicuously glandular-punctate on the lower surface. In addition, it has a peduncle that is conspicuously ribbed.

Anthurium oxystachyum is also similar to *A. gracilispadix* from Chiriquí Province, which shares a similar sharply tapered spadix, but that species has the upper blade surfaces conspicuously glandular-punctate.

COCLÉ: on Atlantic slope near Continental Divide above El Copé, *Croat 44670* (MO, PMA); N of El Copé, *Folsom 5232* (MO); vicinity El Potroso, *Folsom 2387A* (MO), *Sytsma 1895* (MO), *Sytsma & Andersson 4576* (MO).

Anthurium pageanum Croat, sp. nov. TYPE: Panama. Coclé: near Continental Divide along lumber road, 5.2 mi. N of El Copé, 1.5 mi. N of lumber camp, ca. 900 m, cloud forest on steep slopes, *Croat 44596* (MO 2822540, holotype; K, PMA, US, VEN, isotypes; Live at MO).

Planta epiphytica; cataphyllum modice coriaceum, findens in fibris tenuibus, apice plus minusve intactum; petiolus 2.5–20 cm longus, plus minusve triangulatus, glanduloso-punctatus; lamina subcoriacea, lanceolata ad oblongo-elliptica, basi acuta, 11–28 cm longa, 3–7 cm lata, utrinque glanduloso-punctata; inflorescentia foliis breviora; pedunculus (9–)16–30(–43) cm longus, teres; spatha membranacea, pallide viridis leviter suffusa rubro-violacea, oblongo-lanceolata, 3–5 cm longa, 8–15 mm lata; spadix flavovirens, 4.7–6.2 cm longus; baccae rubro-aurantiacae, obovoideae, 4.5–5 cm longae.

Epiphyte; stems short, 0.8–1.8 cm diam.; roots numerous, to 1 cm diam., green, descending; cataphylls moderately thick, 1.5–4 cm long, acuminate at apex, drying brown, weathering into fine persistent fibers, more or less intact at apex. LEAVES erect-spreading; petioles 2.5–20 cm long, 2.4 mm diam., more or less triangular, the margins sharp, sometimes 4–5-winged, conspicuously dark glandular-punctate on surface; geniculum usually 3-sided, 0.5–1.5 cm long, the abaxial rib usually undulate; blades subcoriaceous, lanceolate to oblong-elliptic, short-acuminate (the acumen apiculate, often downturned), acute at base, 11–28 cm long, 3–7 cm wide, broadest at middle or just below; both surfaces semiglossy, the upper surface inconspicuously dark (purple-brown) glandular-punctate, the lower surface paler, dark glandular-punctate; midrib acutely raised above and below; primary lateral veins 7–14 per side, departing midrib at 40–65° angle, more or less straight or weakly curved to collective vein, sunken in valleys above, raised below; interprimary veins scarcely visible; collective vein arising from the base, 2–6 mm from margin, sunken above, raised below. INFLORESCENCE equalling or shorter than leaves; peduncle (9–)16–30(–43) cm long, 2–3 mm diam., terete; spathe thin, pale green, faintly tinged red-violet, oblong-lanceolate, 3–5 cm long, 8–15 mm wide, broadest just above base, short-acuminate at apex, acute to rounded at base, inserted at 55° angle on peduncle; spadix yellow-green (B & K Yellow-green 6/7.5), narrowly tapered to apex, 4.7–6.2(–9) cm long, 3–4 mm diam. at base, 1–2 mm diam. at apex; flowers rhombic to 4-lobed, ca. 4 mm long, ca. 3 mm wide, the sides jaggedly sigmoid, 3–4 flowers visible in the principal spiral, 5–6 visible in the alternate spiral; tepals matte, minutely papillate, the lateral tepals ca. 2 mm wide, the inner margin straight; pistils raised, green; stigmas 0.6 mm long, oblong, darker green than pistil; stamens emerging from near the base, laterals emerging first followed quickly by alternates, stamens retracting after anthesis; anthers white; pollen white. INFRUCTESCENCE erect-spreading, the spadix to 11 cm long; berries red (B & K Red 5/7.5), obovoid, truncate at apex, 4.5–5 mm in both directions; mesocarp thick, fleshy, juicy, translucent; seeds 4, greenish white, weakly flattened, 1.7–2.6 mm long, 1.2–1.9 mm

wide, 1–1.1 mm thick, slightly depressed at apex with a short, sticky, translucent appendage. Figs. 116, 119, and 120.

Anthurium pageanum is endemic to Panama at 300 to 1,200 m in tropical wet and premontane rain forest. Most collections are from the Continental Divide or Atlantic slope in Coclé and Veraguas Provinces, although it was recently collected in Bocas del Toro Province.

The species is in section *Porphyrochitonium* and is distinguished by its epiphytic habit, its oblong-elliptic, glandular-punctate (both surfaces), subcoriaceous leaf blade with prominently sunken major veins and acute lower midrib, and by its sharply three-sided petiole often undulate on the geniculum. Also characteristic are the dark green, gradually tapered spadix, the green lanceolate spathe, and the red berries that are indented at the apex.

It is confused with *Anthurium caloveboranum,* which has similar berries and leaf shape, but the latter differs from *A. pageanum* in having a subterete petiole and in being eglandular on the upper blade surface.

The species is named in honor of Dr. Richard Page of the Cheekwood Botanical Garden who contributed live material for study.

BOCAS DEL TORO: along Chiriquí border on Continental Divide on oil pipeline road, N of Quebrada Arena, *Knapp 5070* (MO).

COCLÉ: Alto Calvario, *Croat 49160* (MO), *Folsom 2336, 3415* (MO), *Folsom & Jaslon 2700* (MO), *Folsom & Page 5976* (MO), *Folsom et al. 8253* (MO); Atlantic slope along Río San Juan above fork of Río Tife, *Hammel 3454* (MO); vicinity of El Copé, *Antonio 1134* (MO, PMA), *3253* (MO), *1179* (MO, US), *Croat 44596* (K, MO, PMA, US, VEN), *44732* (MO, PMA, US), *Hammel 3543, 3601, 4093, 4117, 4140* (MO), *Page 82* (MO); above El Potroso, *Sytsma 1770, 1809* (MO), *Sytsma & Andersson 4574* (MO); road from La Pintada to El Copé, *Hammel 2572* (MO).

PANAMÁ: El Llano-Cartí Road, *Antonio 3309, 3939* (MO), *Kennedy et al. 2403* (F, MO), *Kennedy 2544* (MO), *Sytsma 1065* (MO).

VERAGUAS: valley of Río Tercero Braso, *Croat 27323* (MO); valley of Río Dos Bocas, *Croat 27442* (MO).

Anthurium pallens Schott, Oesterr. Bot. Z. 8: 180. 1858. TYPE: Costa Rica. Near Desengaño, 2,600 m, *Wendland 840* (GOET).

Epiphytic; scandent; cataphylls drying reddish brown, weathering into linear fibers and persisting; petioles subterete, 7–25 cm long, 2.5–6.5 cm diam., narrowly sulcate; blades lanceolate-linear to narrowly oblong-elliptic, 18–34.5 cm long, 2.5–6.5 cm wide. Inflorescence more or less erect; peduncle 10–16 cm long; spathe green, lanceolate, 2.5–3.2 cm long, 0.8–1 cm wide; spadix green turning yellow (sometimes orange), 3–4.5 cm long, 3–6 mm diam. at base; berries green to yellow-green (?), more or less globose. See Croat (1983: 339) for a more complete description.

Anthurium pallens is known from Costa Rica and Panama at 1,000 to 2,000 m in premontane and lower montane rain forest life zones.

The species is a member of section *Xialophyllium* and is recognized by having blades that are acute to rounded at the base. It is easily confused with *Anthurium microspadix* with which it shares similar habitats but differs in having shorter internodes, longer petioles, and blades that dry a characteristic weak glossy gray-green.

BOCAS DEL TORO: NW ridge of Cerro Pata de Macho, *Sytsma et al. 4968* (MO).

CHIRIQUÍ: Cerro Horqueta, *Pittier 3187* (GH, NY); Cerro Pata de Macho, *Croat 48556* (MO, PMA), *Knapp et al. 2099* (DUKE).

Anthurium paludosum Engl., Bot. Jahrb. Syst. 25: 401. 1898. TYPE: Colombia. Valle: near Buenaventura, *Lehmann 3811* (B, holotype).

Epiphytic; stems to 30 cm long; cataphylls drying brown, persisting more or less intact, ultimately deciduous; petioles 3–14 cm long, 3–5 mm diam., D-shaped to subterete, broadly and obtusely sulcate; blades narrowly elliptic to oblanceolate, subcoriaceous, 10–38 cm long, 3–13.5 cm wide, acute to attenuate (rarely obtuse to subrounded) at base. Inflorescence erect-spreading; peduncle 7.5–15.5 cm long, 3–5 mm diam., terete, tinged red-violet; spathe moderately thin, whitish to green or purplish, withering soon after anthesis, oblong-lanceolate, 5.5–7 cm long, 0.4–1.4 cm wide; spadix green, tinged orange, becoming violet purple, 8–14.5 cm long, 6–7 mm diam. at middle; berries orange, red-orange or white tinged with orange, more or less globose to ovoid, 4–6 mm diam.; seeds 3–4. See Croat (1983: 340) for a more complete description.

Anthurium paludosum is known from Costa Rica to Colombia at elevations from sea level to 400 m. West of the Isthmus of Panama it ranges along the Atlantic slope only. To the east of the Isthmus of Panama it occurs on both slopes until

reaching South America where it is restricted to the Pacific slope. The species occurs in wetter parts of tropical moist forest and premontane wet and tropical wet forest life zones.

Anthurium paludosum is a member of section *Porphyrochitonium* and is recognized by its coriaceous, almost oblong leaf blades that are more or less the same color on both sides with a pale green midrib on the upper surface, its thick, persisting intact cataphylls, and by its reddish orange berries. No other species in this section is known to have cataphylls that remain intact.

BOCAS DEL TORO: between Almirante & Ojo del Agua, *Croat 38213* (MO); near Railroad Station at Milla 7.5, *Croat & Porter 16327, 16419* (MO).

CANAL ZONE: Barro Colorado Island, *Croat 8078, 8513, 8520, 8616, 8821, 10970, 11104, 13989* (B, K, MO), *Kenoyer 182* (US), *Shattuck 661* (MO), *Standley 41149* (US).

COCLÉ: Rivera sawmill, N of El Copé, *Folsom et al. 5708* (MO); between Continental Divide & El Potroso, *Sytsma et al. 2377* (MO).

COLÓN: Río Guanche, *Sytsma 1678* (MO); near Río Medio, *Miller 1764* (US); Santa Rita Ridge Road, *Antonio 3759* (MO), *Lewis et al. 5378* (MO).

DARIÉN: Río Mortí, *Duke 14174, 14203* (MO); vicinity gold mining camp of Tyler Kittredge, *Croat 27129* (MO).

PANAMÁ: El Llano-Cartí Road, *Croat 25103, 33709, 33815* (MO), *Folsom & Skog 2469* (MO), *Kennedy 2508, 2716* (MO, US), *Liesner 645, 1158* (MO), *1211* (MO, US), *Mori et al. 4102* (MO, WIS), *Nee 10530* (MO), *Sytsma 1033* (MO), *Tyson & Nee 7343, 7346* (MO).

SAN BLAS: Aila Tiwar, *Sugden 486* (MO); Río Kwadi, SW of Mulatupo, *Duke 14227* (MO); El Llano-Cartí Road, *Knapp 1829, 1838, 1869* (MO), *1868* (F, K, MO), *Sytsma & Andersson 4477* (K, MO).

Anthurium panamense Croat, sp. nov. TYPE: Panama. Veraguas: along the road between Santa Fe and Calovébora, beyond the Escuela Agricola Alto Piedra, on banks of the first major stream ca. 3 mi. from the school, ca. 700 m, 8°34′N, 81°09′W, *Croat 49001* (MO 2726772–74, holotype; PMA, isotype).

Plerumque epiphytica, interdum terrestris; cataphyllum modice coriaceum, basi findens, ultimo deciduum; petiolus anguste et argue sulcatus; lamina coriacea, oblongo-ovata, interdum anguste ovata, basi profunde cordata, 52–85 cm longa, 17–52 cm lata; nervis primariis lateralis 10–24; inflorescentia erecta; pedunculus teres, 23–42 cm longus; spatha viridis ad flavovirens interdum suffusa purpurea, 11–12(–22) cm longa, 1.1–2.9(–3.8) cm lata; oblongo-lanceolata; spadix cremeus purpurescens, 15–25 cm longus, baccae rubrae, oblongo-ellipsoideae, 9–10 mm longae, 3.5–4.5 mm diam.

Usually epiphytic, sometimes terrestrial on steep banks or on rocks; stems to ca. 60 cm long, 2–3.5 cm diam., leaf scars to 4 cm diam.; internodes short or to 2 cm long; cataphylls 14–25 cm long, moderately coriaceous, sometimes weakly striate, acute and apiculate at apex, green, sometimes tinged with purple, drying brownish, caducous or weathering toward the base, then deciduous. LEAVES with petioles brittle, semierect, 60–90 cm long, 8–12 mm diam. midway, narrowly and sharply sulcate adaxially, weakly striate longitudinally around the circumference, green sometimes tinged with purple; geniculum 3–4 cm long, shaped like petiole, smooth or weakly ribbed; blades coriaceous, epunctate, usually oblong-ovate, sometimes narrowly ovate, acuminate at apex, deeply cordate at base, 52–85 cm long, 17–52 cm wide, broadest well below the middle, the margin more or less straight; anterior lobe 40–80 cm long, broadly convex along the margin; posterior lobes directed basally, 10–24 cm long (from point of petiole attachment to outermost point); sinus usually obovate, generally closed, sometimes hippocrepiform, obtuse to rounded at apex; upper surface matte to semiglossy, weakly velvety and somewhat bullate, drying matte; lower surface matte, slightly paler; midrib prominently raised above, sharply acute, becoming narrower than high in the apical part of the blade, prominently raised beneath, often weakly ribbed; basal veins 5–8 pairs, the first free, the second usually free (approaching petiole at a broad angle approximately 90°), the third rarely free, usually coalesced 1–2 cm with the fourth and higher order veins, the remaining basal veins coalesced to varying degrees, mostly 3–6 cm; posterior rib naked, slightly curved; primary lateral veins 11–20 per side, prominently sunken above, prominently raised beneath; interprimary veins present, usually much less conspicuous than the primary lateral veins; secondary veins in part sunken above; tertiary veins drying prominulous on the lower surface; collective vein arising usually from the second or third basal vein, often prominently loop-connected from the lowermost basal veins, mostly 3–6 mm from the margin, rarely to 10 mm. INFLORESCENCE much shorter than the leaves, usually stiffly erect at anthesis; peduncle 23–42 cm long, one-third to one-half as long as the petioles, terete, smooth, sometimes tinged with purple; spathe green to yellowish green, sometimes tinged with purple (at least on veins), brittle, strongly reflexed and sometimes twisted, oblong-lanceolate, 11–20 cm

long, 1.1–3.8 cm wide, broadest just above the base, acuminate at apex, acute at the base, inserted at ca. 45° angle on peduncle; spadix creamy white becoming purplish violet in age, elongate, gradually tapered, 15–25 cm long, 1–1.6 cm diam. near the base, 7–9 mm diam. near the apex, the apex rounded; flowers rhombic, 1.6–2.5 cm long (dried), 1–2.1 mm wide, 19–24 flowers visible in the principal spiral, 14–15 flowers visible in the alternate spiral, the sides sigmoid; tepals epunctate, the lateral tepals 0.3–0.7 mm wide, the inner margin broadly rounded to straight, drying thin, the alternate margin drying prominently upturned, appearing concave; pistils weakly emergent at or slightly after anthesis; stamens weakly exserted above the tepals, filaments weakly exposed, much broader than the anthers, held in a relatively tight cluster around and obscuring the pistil; anthers creamy white, 0.4 mm long, 0.3–0.4 mm wide; thecae not divaricate; pollen whitish. INFRUCTESCENCE 30–40 cm long, 2.5–3.5 cm diam. with berries exposed, berries red, oblong-ellipsoid, 9–10 mm long, 3.5–4.5 mm diam., blunt at both ends, densely arrayed with slender, linear, raphide cells in the apical half; seeds 1–2, oblong-elliptic, 3–3.5 mm long, 1.7–2 mm wide, 1.1–1.2 mm thick, appendaged at one or both ends, sometimes enveloping the entire seed. Figs. 129 and 130.

Anthurium panamense is endemic to Central Panama in Veraguas and Coclé Provinces at 350 to 800 m in tropical wet and premontane rain forest life zones.

The sectional placement of the species is uncertain; it is, however, provisionally placed in section *Belolonchium*. It is recognized by conspicuously striate petioles and much elongated, oblong-ovate blades with the anterior lobes usually three or more times longer than the posterior lobes and with numerous primary lateral veins. Other distinguishing features include the short pedunculate inflorescence with a long, tapered whitish spadix, the reflexed, greenish, oblong-lanceolate spathe, and the long infructescence with red berries.

The species is most easily confused with *Anthurium hebetatum,* which has leaves drying similarly matte and are also much elongated. That species differs, however, in having the blades broadest well above the base whereas the blades of *A. panamense* are broadest at the base. *Anthurium panamense* may also be confused with *A. dukei,* which is found in Darién Province in the Serranía de Pirre. That species differs by having a shorter blade, a maroon spadix, and a longer inflorescence.

COCLÉ: NE slopes & summit of Cerro Caracoral, *Sytsma 4093* (MO); foot of Cerro Pilón, *Porter et al. 4660* (MO, US); 5 hour walk from sawmill at El Copé, *Antonio 3615* (MO); between Río Blanco & Caña Sucio, *Sytsma et al. 2452* (MO).

VERAGUAS: on slopes of Cerro Tute, *Croat & Folsom 34235* (F, MO); between Escuela Agricola Alto Piedra & Río Calovébora, *Croat & Folsom 34146* (F, MO, PMA, US); headwaters of Río Caloveborita, *Sytsma & Andersson 4770* (MO); vicinity Santa Fe, *Coons 1414* (FTG), *Croat 23015, 27400, 27633* (MO), *49001* (MO, PMA), *Liesner 804* (MO), *Mori 6226* (MO).

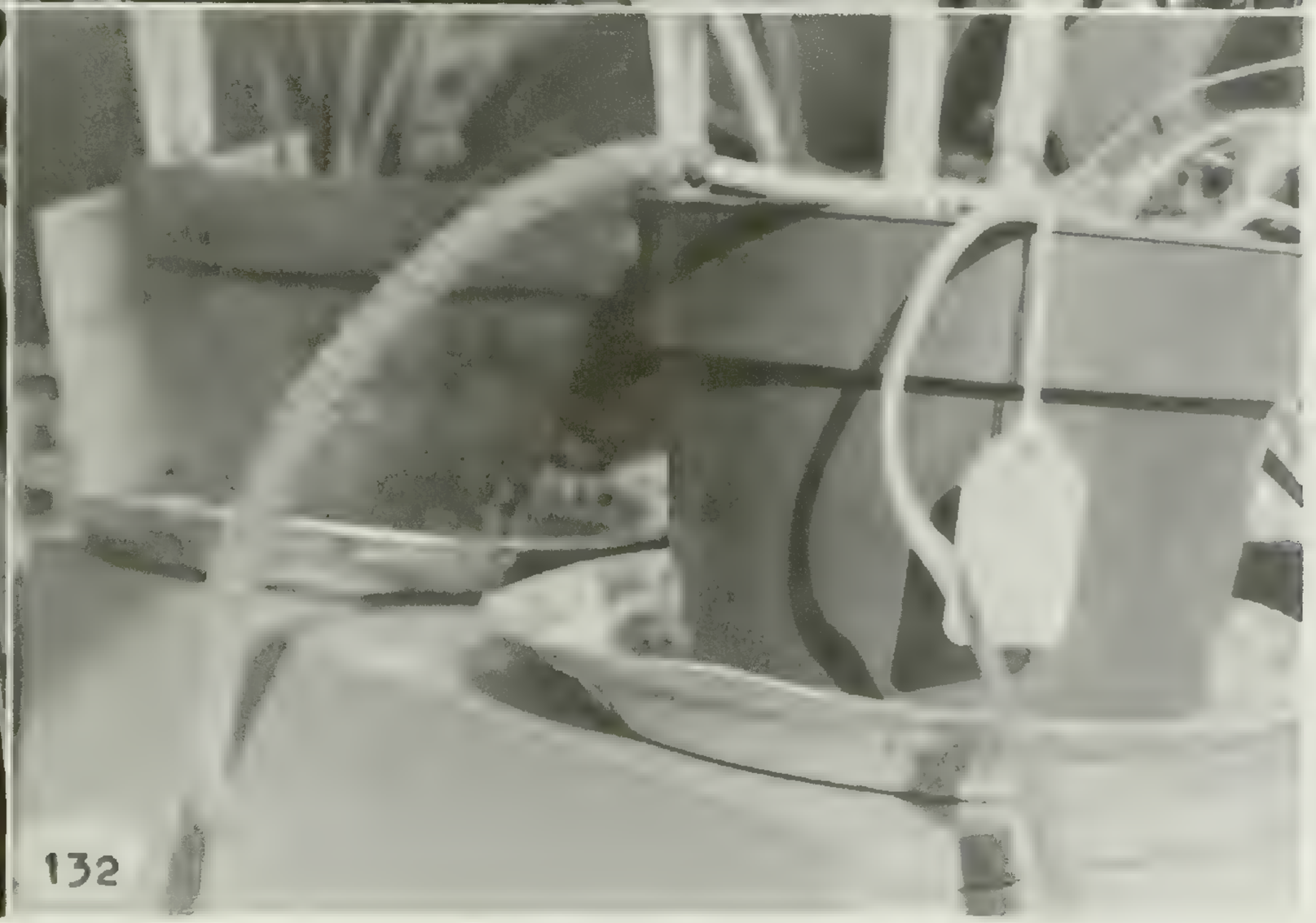
Anthurium panduriforme Schott, Prod. Aroid. 536. 1860. *Anthurium panduratum* Schott, Oesterr. Bot. Z. 8: 182. 1858 non Mart. ex Schott, 1855. TYPE: Costa Rica. San Miguel, *Wendland 776* (GOET).

Epiphytic or occasionally terrestrial; stems usually less than 30 cm long, occasionally to 1 m long; cataphylls drying tan, usually deciduous, with a few thin fibers sometimes persisting; petioles 25–73 cm long, 3–7 mm diam., terete, sometimes weakly sulcate; blades hastate-trilobate, 20–65 cm long, 10–43 cm wide, prominently lobed at base. Inflorescence erect; peduncle (5–)11–20(–32) cm long, 4–6 mm diam., terete; spathe moderately thin, pale green, sometimes tinged reddish, oblong-lanceolate, 6.3–19 cm long, 2.7–3.5 cm wide; spadix golden yellow, 7–18 cm long, 7–9 mm diam. midway; berries pale green, ovoid, 5–7 mm long, seeds 2. See Croat (1983: 341) for a more complete description.

The species is known from Costa Rica to Colombia and probably Ecuador at 400 to 1,560 m in tropical wet, premontane rain, and lower montane rain forest. In Panama the species occurs on both slopes.

Anthurium panduriforme is probably best placed in section *Polyneurium* and is distinguished by its almost orbicular posterior lobes (sometimes more elongate in Panama, particularly collections made at Cerro Tute near Santa Fe in Veraguas Province), its characteristically yellow-green, shiny lower blade surface, and its golden yellow spadix with yellow pollen. The species is apparently not related to any other Central American species but is probably related to other South American species, such as *A. argyrostachyum* Sodiro of Ecuador, which have numerous closely parallel primary lateral veins.

FIGURES 125–128. 125. *Anthurium rubrifructum* Croat, *Folsom 4287*. —126. *Anthurium sapense* Croat, *Hammel 1168*. —127, 128. *Anthurium papillilaminum* Croat, *Cirino 4*.



FIGURES 129–132. 129, 130. *Anthurium panamense* Croat, *FTG 76-672.*—131. *Anthurium roseospadix* Croat, *Croat 15226.*—132. *Anthurium pendens* Croat, *Croat 34296A.*

Schott's original spelling of the name appeared as *Anthurium panduraeforme,* but the spelling has been changed to reflect current rules of nomenclature.

BOCAS DEL TORO/CHIRIQUÍ: Cerro Colorado, *Folsom 4868* (MO).

CHIRIQUÍ: Cerro Colorado, *Antonio 4903* (MO), *Croat 33335, 37308* (MO), *Folsom & Mauseth 8448* (MO), *Sullivan 376* (MO); road between Gualaca & Fortuna Dam site, *Antonio 4073* (MO); road to Fortuna Dam site, *Croat 48685, 49839* (MO), *50091* (MO, PMA); N of San Félix at Chiriquí/Bocas del Toro border, *Mori & Kallunki 5859, 5949* (MO).

COCLÉ: Alto Calvario, *Croat 49179* (MO), *Folsom 3235* (MO), *Folsom & Collins 6520* (MO); Cerro Caracoral, *Knapp 1144* (MO, PMA), *Sytsma 3765, 3790* (MO); Cerro Pilón, *Duke & Lallathin 15025* (MO), *Dwyer et al. 4482, 4509* (MO), *Sullivan 551* (MO); vicinity El Copé, *Croat 44593A* (MO), *Folsom & Robinson 2356* (MO), *Folsom et al. 5677* (MO), *Hammel 777, 3532* (MO), *Sytsma & Andersson 4621* (MO, PMA); N of El Valle de Antón, *Lewis 1787* (MO).

DARIÉN: Cerro Pirre, *Folsom et al. 6337* (MO), *Gentry & Clewell 7029* (MO); Serranía de Pirre, *Croat 37825* (CAS, MO, NY, PMA, US, VEN), *37881* (MO).

DARIÉN/CHOCÓ (COLOMBIA): Alturas de Nique, *Gentry et al. 28723* (MO).

PANAMÁ: NE of Altos de Pacora, *Croat 22694* (MO), *Mori & Kallunki 6054* (MO).

VERAGUAS: Cerro Tute, *Croat 48947* (MO), *Folsom 3029* (MO), *Mori et al. 7576* (MO), *Witherspoon et al. 8871* (MO, US); vicinity Escuela Agricola Alto Piedra, *Antonio 3490* (MO); on road to Río Calovébora, *Croat & Folsom 33964* (MO, PMA), *Croat 34240, 48992* (MO, PMA); vicinity Santa Fe, *Croat 23103, 27712* (MO), *Liesner 890* (MO), *Mori & Kallunki 4839, 6138* (MO).

Anthurium papillilaminum Croat, sp. nov. TYPE: Panama. Colón: hill slope in Achiote, *Dressler 6033* (MO 2927339, holotype; US, isotype).

Planta terrestris; cataphyllum basi findens, apice persistens intactum; petiolus subteres, 16.5–34 cm longus, leviter sulcatus; lamina modice membranacea, oblongo-ovata ad anguste ovata, basi cordata, 25–43 cm longa, 11.5–26 cm lata, pagina superiore velutina; inflorescentia erecta et effusa, foliis longiore; pedunculus teres, 28.5–54 cm longus; spatha modice membranacea, viridis suffusa rubro-violaceae, lanceolata, 6.3–12 cm longa, 0.8–1.8 cm lata, stipite 4–14 mm longo; spadix viridis, 3–13.5 cm longus; baccae ignotae.

Terrestrial; stems ca. 10 cm long, ca. 3 cm diam.; leaf scars 2.5 cm wide; roots green, medium thick, descending; cataphylls 4–6 cm long, drying brown (B & K Yellow 4/2.5), persisting intact at apex, splitting at base. LEAVES with petioles erect-spreading, sometimes the blade held parallel to petiole; petioles 16.5–34 cm long, 4–6 mm diam., subterete, sometimes very shallowly sulcate, dark olive green, sometimes tinged reddish to red-violet; geniculum 1–1.5 cm long, pale green at base of blade or sometimes tinged red-violet; blades oblong-ovate to narrowly ovate, moderately thin, acuminate at apex (the acumen flat), lobed at base, 25–43 cm long, 11.5–26.5 cm wide; anterior lobe 19–30.4 cm long, the margins rounded; posterior lobes 6.5–13.5 cm long; sinus hippocrepiform to nearly triangular, rounded to acute at apex; both surfaces matte, densely papillate; upper surface deep green, velvety, lower surface pale olive green; midrib narrowly and acutely raised above, diminished and flat toward apex, narrowly and acutely raised below; basal veins 4–5 pairs, the first and second free to the base, those remaining coalesced 0.5–1 cm, paler than surface and raised above, flat to weakly raised below, sometimes tinged reddish; posterior ribs naked, the outer margin turned up; primary lateral veins 3–4 per side, departing midrib at 35–45° angle; usually straight to collective vein, prominulous above, flat below; interprimary veins scarcely visible above, conspicuous below; collective vein arising from the first basal vein, forming an acute angle with the margin, sunken above, raised below, 1.5–3.5 cm from the margin. INFLORESCENCE erect-spreading, longer than leaves; peduncle 28.5–54 cm long, 3–6 mm diam., terete, heavily tinged red-violet, one and a half to two times longer than the petioles; spathe moderately thin, green tinged with red-violet, lanceolate, 6.3–12 cm long, 0.8–1.8 cm wide, broadest near the base, gradually acuminate at apex, obtuse and unequal at base, inserted at ca. 30° angle on peduncle; stipe 4–14 mm long, faintly tinged red-violet; spadix green (B & K Yellow-green 6/10), tapered toward apex, 3–13.5 cm long, 4.5–9 mm diam. near base, 3–4 mm diam. at apex; flowers sub-4-lobed 2–2.9 mm long, 2.3–3 mm wide, the sides straight to jaggedly sigmoid, 5–6 flowers visible in the principal spiral, 4–8 flowers visible in the alternate spiral; tepals matte to semiglossy, minutely papillate; lateral tepals 0.8–1.5 mm wide, the inner margin obtusely angular to concave; pistils emergent, green; stigma linear-elliptic, brush-like, drying brown; stamens emerging from the base, the laterals emerging nearly to apex before the alternates emerge; anthers cream, held against pistil at edge of tepals, ca. 0.5 mm long, 0.8 mm wide; thecae oblong, not divaricate; pollen cream-colored. INFRUCTESCENCE not seen. Figs. 127 and 128.

Anthurium papillilaminum is known from central Panamá and eastern Darién Provinces near the Colombian border from sea level to 100 m.

The species is a member of section *Cardiolonchium* and is characterized by its terrestrial habit, its dark blackish green, velvety leaf blade with only slightly paler major veins, and by its inflorescence with a green spadix held well above the leaves.

It is closest to *Anthurium crystallinum,* which differs by having an epiphytic habit, a yellowish spadix, and a pale area along its major veins (midrib and basal veins). The latter has been collected only on Cerro Pirre in Panama, while *A. papillilaminum* is known only from lower elevations in the region of the isthmus.

Anthurium papillilaminum is largely known from cultivated material and has been collected in the wild for certain only near Achiote (west of the Panama Canal near sea level) and along the Río Guanche at less than 100 m.

A collection of unknown origin (*Newbill 1*) is perhaps also this species. It differs in that it is reported to have a yellow spadix.

COLÓN: Achiote, *Dressler 6033* (MO, US), *Sheffer 171, 271* (MO).

DARIÉN: 1,200 ft., no other location, *Newbill 1* (F).

Anthurium pauciflorum Croat, sp. nov. TYPE: Panama. Chiriquí: Fortuna Hydroelectric Project, forested slope above the Aoki camp, 1,200–1,400 m, *Folsom et al. 8145* (MO 2807246, holotype).

Planta epiphytica; cataphyllum persistens in fibris tenuibus, linearibusque; petiolus anguste sulcatus, 10–21 cm longus; lamina ovata ad ovato-triangulata, modice membranacea, basi cordata, 15–21 cm longa, 8–10 cm lata; inflorescentia foliis breviora, erecta; pedunculus 4.5–8 cm longus; spatha subcoriacea, viridis, lanceolata, 2.7–3 cm longa, 5–7 mm lata; spadix lutens paucifloribus, 2–3 cm longus; baccae ignotae.

Epiphyte; stems 4–6 cm diam.; internodes elongate; roots thin; cataphylls ca. 4.5 cm long, drying tan, persisting around stem, weathering to fine longitudinal fibers. LEAVES with petiole erect-spreading, 10–21 cm long, narrowly sulcate; geniculum ca. 1 cm long; blades ovate to ovate-triangular, moderately thin, long-acuminate at apex, lobed at base, 15–21 cm long, 8–10 cm wide, broadest at base or at point of petiole attachment; anterior lobe 13.7–20 cm long, margin straight to convex; posterior lobes 4–6 cm long, from apex of sinus to outermost point; sinus parabolic to hippocrepiform, the apex rounded; both surfaces matte (dry), the lower surface markedly paler; midrib raised above and below (dry); basal veins 4–5 pairs, the first and second free to the base, those remaining coalesced 0.7–1 cm, raised above and below (dry), yellow on lower surface; primary lateral veins 5–6 per side, departing midrib at 45–60° angle, prominulous above, raised below (dry), straight to weakly arching near collective vein; lesser veins conspicuous on drying; collective vein arising from the first or second basal vein, sometimes from one of the lower basal veins, prominulous above, raised below (dry). INFLORESCENCE shorter than leaves, erect; peduncle 4.5–8 cm long, 1–2 mm diam.; spathe green, subcoriaceous, lanceolate, 2.7–3 cm long, 5–7 mm wide, strongly reflexed, long-acuminate at apex; spadix yellow, cylindroid, rounded at apex, 2–3 cm long, ca. 3 mm diam. midway; flowers rhombic 2–2.4 mm long, 1.8–2 mm wide, the sides straight to weakly sigmoid; 3 flowers visible in the principal spiral, 5–6 flowers visible in the alternate spiral; tepals matte (dry), lateral tepals 0.7–0.8 mm wide, the inner margin straight to convex; pistils exserted; stigma linear, 0.4 mm long; not seen at anthesis. INFRUCTESCENCE not seen. Fig. 115.

Anthurium pauciflorum is endemic to Panama in premontane rain forest at elevations of 1,200 to 1,400 m. The species has been collected only twice in the Fortuna Dam area.

It is a member of section *Xialophyllium* and is distinguished by its moderately thin, ovate-triangular to ovate, long-acuminate, cordate blades and by its somewhat elongate internodes but especially by its short inflorescence (shorter than leaves) with relatively few-flowered (thus the name) spirals on the spadix (usually three or fewer flowers visible per spiral).

The species may be confused with small-leaved plants of *Anthurium caperatum,* a species that occurs in the same area. The latter species differs, however, in having many more flowers per spiral (12–15).

CHIRIQUÍ: Fortuna Dam site, *Folsom et al. 5566, 8145* (MO).

Anthurium pendens Croat, sp. nov. TYPE: Panama. Colón: Santa Rita Ridge Road, along trail at end of road that goes to Río Indio, beginning 10.6 km from Transisthmian

Hwy., 3 km beyond hydrographic station, ca. 380 m, *Croat 34296A* (MO 2815427, holotype; K, PMA, isotypes; Live at MO).

Planta pendens, epiphytica; cataphyllum persistens fibrosum, reticulum, grossum; petiolus teres, 8–22 cm longus; lamina coriacea, anguste linearis-oblanceolata, basi acuta, utrinque sparsim et inconspicuo glanduloso-punctata; inflorescentia effusa aut pendula; pedunculus teres, 4.5–15 cm longus, spatha membranacea, viridulus-alba, oblonga ad oblongo-lanceolata, 7–7.5 cm longa, 1.5–2.5 cm lata; spadix roseus virides-cens brunneus, 12–18 cm longus; baccae aurantiacae, depresso-globosae, 5 mm longae.

Pendent epiphyte; stems ca. 10 cm long, 1–2.5 cm diam.; internodes to 2 cm long, shorter near apex; leaf scars 1.2 cm wide, often obscured by persistent cataphyll fibers; roots moderately thin, green; cataphylls moderately thick, 7–10 cm long, drying tan, weathering into coarse reticulate fibers. LEAVES pendent; petioles 8–22 cm long, 4–5 mm diam., terete, with reddish brown glands on surface; geniculum 0.5–1 cm long; blades coriaceous, narrowly linear-oblanceolate, long-acuminate at apex, acute at base, 41–75 cm long, 3–12.5 cm wide, usually broadest above middle; both surfaces matte to semiglossy, sparsely and inconspicuously glandular-punctate (conspicuous on drying); lower surface scarcely paler than upper surface; midrib acutely raised above, flat at apex, convexly raised below; primary lateral veins 8–12 per side, departing midrib at 10–20° angle, scarcely visible above or below, prominulous on drying; interprimary veins scarcely visible, drying as prominent as primary lateral veins; collective vein arising from the base, 3–15 mm from margin. INFLORESCENCE spreading to pendent, much shorter than leaves; peduncle terete, 4.5–15 cm long 3.5–5 mm diam., as long as petioles; spathe thin, greenish white, oblong to oblong-lanceolate, 7–7.5 cm long, 1.5–2.5 cm wide, broadest at middle, abruptly acuminate at apex, obtuse to rounded at base, inserted at 35° angle on peduncle, usually withering early and deciduous; spadix pink, turning greenish brown before anthesis, 12–18 cm long, 5–8 mm diam. near base, 4–6 mm diam. near apex, the flowers square to rhombic, 2.9–4 mm wide, 2.9–3.5 mm long, the sides straight to sigmoid parallel to spirals, sigmoid perpendicular to spirals, 5–6 flowers visible in the principal spiral, 7–8 flowers visible in the alternate spiral; tepals semiglossy, the lateral tepals 1.8–2 mm wide, the inner margins broadly rounded; pistils weakly emergent; stigmas ellipsoid 0.4–0.6 mm long, with a small droplet apparent before stamens emerge; stamens emerging in a scattered manner usually beginning at the base but the laterals soon scattered throughout spadix, exserted on thin, clear filaments ca. 2 mm long, retracting to hold anthers close against pistil; anthers white, 0.5–0.6 mm long, 0.6–0.7 mm wide; thecae ovate, moderately divaricate; pollen white. INFRUCTESCENCE pendent; spathe deciduous; spadix to 22 cm long with berries exserted; berries orange (B & K Yellow 8/2.5), depressed globose, 5 mm long, 5 mm diam.; mesocarp gelatinous, yellow with numerous raphide cells; seeds (1–)2, pale yellow, ovoid, 2–2.7 mm long, 1–1.6 mm wide, with brownish appendage at base. Figs. 132, 133, and 134.

The species occurs in a small area on the border between Panama and Colombia (Chocó). In Panama it is also known from Colón, Panamá, and Darién Provinces at 100 to 450 m in tropical wet and lower montane rain forest. A collection from Cerro Sapo in Darién Province (*Hammel 1199*) is possibly also this species. It was collected at 830 m elevation and has a longer spadix (to 25 cm long) and a thin, papery epidermis loosely attached to the cataphyll fibers; its leaves match those of *Anthurium pendens* very well. *Gentry & Folsom 7354,* a collection from Colombia in the Department of Chocó (Alto de Buey) at 1,200 to 1,800 m, may also be this species. I have seen only a sterile specimen, but the label indicates that it had a short brown inflorescence, which fits this species.

Anthurium pendens is a member of section *Porphyrochitonium* and is distinguished by very elongate, narrowly oblanceolate, pendent, glandular-punctate leaves (from whence it derives its name) that are acute at the base, dry markedly blackened and have the primary lateral veins departing midrib at an angle of 10–20°. It is also distinguished by its relatively short, straight, pinkish spadix that turns greenish brown before anthesis.

The species is closely related to *Anthurium wendlingeri,* which has similar, elongate, coriaceous, glandular-punctate blades with an identical texture and comparable punctations. The latter differs, however, in having blades that are oblong-linear, broadest near the middle or below the middle with a rounded base, with veins that depart the midrib at a 20–40° angle, and with blades that dry yellowish green, not at all blackened. Most importantly, it has a much longer, more slender inflorescence that is white to gray-

FIGURES 133–136. 133, 134. *Anthurium pendens* Croat, *Croat 34296A*.—135. *Anthurium rupicola* Croat, *Croat 27526*.—136. *Anthurium tacarcunense* Croat, *Gentry & Mori 14075*.

ish at anthesis and soon coils into a helicoid spiral.

Smaller plants of *Anthurium pendens* have been confused with *A. friedrichsthalii,* but the former can be distinguished in that it has slightly broader blades that dry darker, and it tends to have stamens exposed on drying. Blades of *A. friedrichsthalii* usually dry light greenish brown, and the anthers are strongly retracted on drying.

COLÓN: Río Guanche, *Croat 37006* (MO), *Gentry 8815* (MO); Santa Rita Ridge Road, *Croat 34296A* (K, MO, PMA); below Cerro Bruja, along Río Escandaloso, 100–200 m, *Kress & Knapp 82-1393* (DUKE).

DARIÉN: Cerro Sapo, *Hammel 1199* (MO); Alturas de Nique, headwaters of Río Cuasí, *Hartman 12296* (MO).

PANAMÁ: Cerro Jefe, *Folsom 3849* (MO); El Llano-Cartí Road, *Nee et al. 8758* (MO).

Anthurium pentaphyllum (Aubl.) G. Don in Sweet, Hortus Brit., 3rd ed., 633. 1839.

Anthurium pentaphyllum var. **bombacifolium** (Schott) Madison, Selbyana 2: 278. 1978. *Anthurium bombacifolium* Schott, Oesterr. Bot. Z. 8: 182. 1858. TYPE: Costa Rica. Near Atenas, *Hoffmann 779* (B, type destroyed; Photo of Schott Aroid Drawing #829, NYBG Neg. #N.S.3934).

Anthurium aemulum Schott, Bonplandia 7: 165. 1859. TYPE: Mexico. Colipa, *Liebmann 15799* (C?, not seen; Photo, D. Nicolson, 2 June 1963-13).

Anthurium karwinskyi Schott, Oesterr. Bot. Z. 9: 101. 1859. TYPE: Mexico. Veracruz: Colipa, *Karwinsky s.n.* (LE).

Epiphytic; stems creeping up tree trunks; cataphylls caducous or persisting as coarse fibers; petioles 19–44 cm long, ca. 5 mm diam., terete; blades digitately compound with 5–11 leaflets, moderately thin, leaflets oblanceolate to narrowly elliptic, 13–30 cm long, 2.5–9 cm wide, the median leaflet equilateral, the lateral leaflets inequilateral, cuneate-attenuate at base. Inflorescence erect; peduncle 1–6 cm long; spathe pale green to purple, lanceolate to ovate, moderately thick, 6–10 cm long, 1–2.8 cm wide, early deciduous; spadix pale violet purple, 2.2–10(–15) cm long, 8–20 mm diam. at base; berries red to dark red-violet, more or less ellipsoid, 5–8 mm diam. See Croat (1983: 348) for a more complete description.

Anthurium pentaphyllum var. *bombacifolium* is known from Mexico to Panama at elevations from near sea level to 800 m, occurring principally on the Atlantic slope in Mexico and Middle America but on both slopes in Costa Rica and Panama. The species occurs in premontane moist, tropical moist, premontane wet, and tropical wet forest life zones making it one of the most ecologically variable species of *Anthurium* in Central America.

The species is a member of section *Dactylophyllium* and is most easily confused with *Anthurium kunthii,* which has similar leaves. *Anthurium kunthii* differs, however, in having a longer peduncle, three-fourths the length of the petiole, a long, slender, greenish spadix, and lateral leaflets that are more or less equilateral at the base.

CANAL ZONE: near Piña, *Gentry 8634* (MO).

CHIRIQUÍ: W of Puerto Armuelles, *Liesner 50* (MO).

COCLÉ: road between Llano Grande & Coclecito, *Antonio 3558* (MO); W of Llano Grande, just S of Cascajal, *Hammel & D'Arcy 5096* (MO); N of Penonomé, *Hammel 1639* (MO); along Río San Juan above fork of Río Tife, *Hammel 3449* (MO).

COLÓN: Achiote, *Folsom et al. 5799* (MO); SW of Portobelo, *Liesner 1030* (MO); Santa Rita Ridge, *Foster 1759* (DUKE).

DARIÉN: no other location, *Duke & Bristan 225* (MO); Camp Summit, *Oliver et al. 3668* (MO).

PANAMÁ: Cerro Jefe, *Busey & Croat 267* (MO), *Sheffer 119, 120, 148* (MO), *168* (UH); El Llano-Cartí Road, *Folsom s.n.* (MO); La Eneida, *Luteyn & Kennedy 1746* (DUKE); Río Majé, *Croat 34575, 34649* (F, MO); vicinity Escuela Agricola Alto Piedra, *Antonio 4940* (MO).

Anthurium pirrense Croat, sp. nov. TYPE: Panama. Darién: Serranía de Pirre, ca. 12 km N of Alturas de Nique, lower montane rain forest, 1,520–1,560 m, *Croat 37900* (MO 2400316, holotype; F, GH, K, PMA, SEL, US, isotypes; Live at MO).

Planta epiphytica; cataphyllum subcoriacea, basi findens, apice persistens intactum; petiolus subteres, leviter sulcatus, 12–31 cm longus; lamina modice coriacea, lanceolata ad oblongo-elliptica, basi obtusa ad rotundata, 20–29 cm longa, 8–12 cm lata; pagina inferiore glanduloso-punctata; inflorescentia effusa; pedunculus interdum leviter costatus, 19–48 cm longus; spatha subcoriacea, pallide viridis, lanceolata, 5–6.5 cm longa, 1.3–1.5 cm lata, spadix viridis ante anthesin, aurantiacentes, 9–15 cm longus; baccae ignotae.

Epiphyte; stems short; leaf scars hidden by cataphylls; roots moderately thin, greenish, descending; cataphylls subcoriaceous, 4.5–5 cm long, minutely apiculate at apex, drying medium brown, splitting at base, persisting more or less

intact at apex. LEAVES erect-spreading; petioles 12–31 cm long, 6–7 mm diam., subterete, shallowly sulcate, the margins erect; geniculum 1.5–3 cm long; blades moderately thick, lanceolate to oblong-elliptic, abruptly acuminate at apex (the acumen downturned), obtuse to rounded at base, 20–29 cm long, 8–12 cm wide, broadest below middle; both surfaces semiglossy, the lower surface much paler, dark glandular-puncate; midrib convexly raised above, diminishing and sunken toward apex, convexly raised below; primary lateral veins 7–8(–12) per side, departing midrib at 55° angle, sunken above, raised below, more or less straight to collective vein; interprimary veins weakly sunken above, prominulous below; lesser veins scarcely visible below; collective vein arising from near the base or from one of the lowermost primary lateral veins, sunken above, raised below, 5–7 mm from margin. INFLORESCENCE spreading, equalling or longer than leaves; peduncle 19–48 cm long, 4–5 mm diam., sometimes faintly ribbed; spathe medium thick, pale green (B & K Green 8/2.5), lanceolate, 5–6.5 cm long, 1.3–1.5 cm wide, broadest at base, the margins tightly turned under, sometimes twisting longitudinally, inserted at 70° angle on peduncle; decurrent to 9 mm; spadix green (B & K Yellow-green 8/10), turning orange-brown before anthesis, lengthening markedly during anthesis, 9–15 cm long, ca. 5 mm diam. near base, ca. 2 mm diam. near apex; flowers rhombic, 2.5 mm in both directions, the sides more or less straight, 5–6 flowers visible in the principal spiral, 7–9 visible in the alternate spiral; tepals glossy, minutely papillate, lateral tepals ca. 1.9 mm wide, the inner margins straight; pistils raised, pale yellow-green; stigma ovate, ca. 3 mm long; stamens emerging slowly, more or less scattered or beginning at the base, the lateral stamens emerging to apex before alternates appear, only tip of anthers exposed, anthers greenish white, 0.2–0.5 mm long, 0.5–0.7 mm wide, scarcely exposed, held at edge of pistil; thecae oblong, not divaricate; pollen white. INFRUCTESCENCE not seen. Figs. 137 and 138.

Anthurium pirrense is endemic to the Serranía de Pirre in western Darién Province of Panama. All collections have been made from the vicinity of the type locality in lower montane rain forest at 1,400 to 1,600 m.

The species, a member of section *Porphyrochitonium*, is distinguished by its epiphytic habit, its short stems with persistent, weathered cataphylls, its subterete petioles subequalling blades with a flat, erect-margined sulcus adaxially, and by its oblong-elliptic, subcoriaceous blades with the collective vein relatively remote from the margin. Also characteristic are its inflorescence subequalling leaves and its slender, orange-brown spadix with a purplish ring around the pistil (inner margin of tepals purplish). It is similar to *Anthurium crassitepalum* with which it occurs, but that species has thinner blades on drying and lacks the prominently raised collective vein of *A. pirrense*. More importantly, *A. crassitepalum* differs in having a greenish to yellow spadix with a "cobbled" appearance owing to its thickened, somewhat elevated tepals.

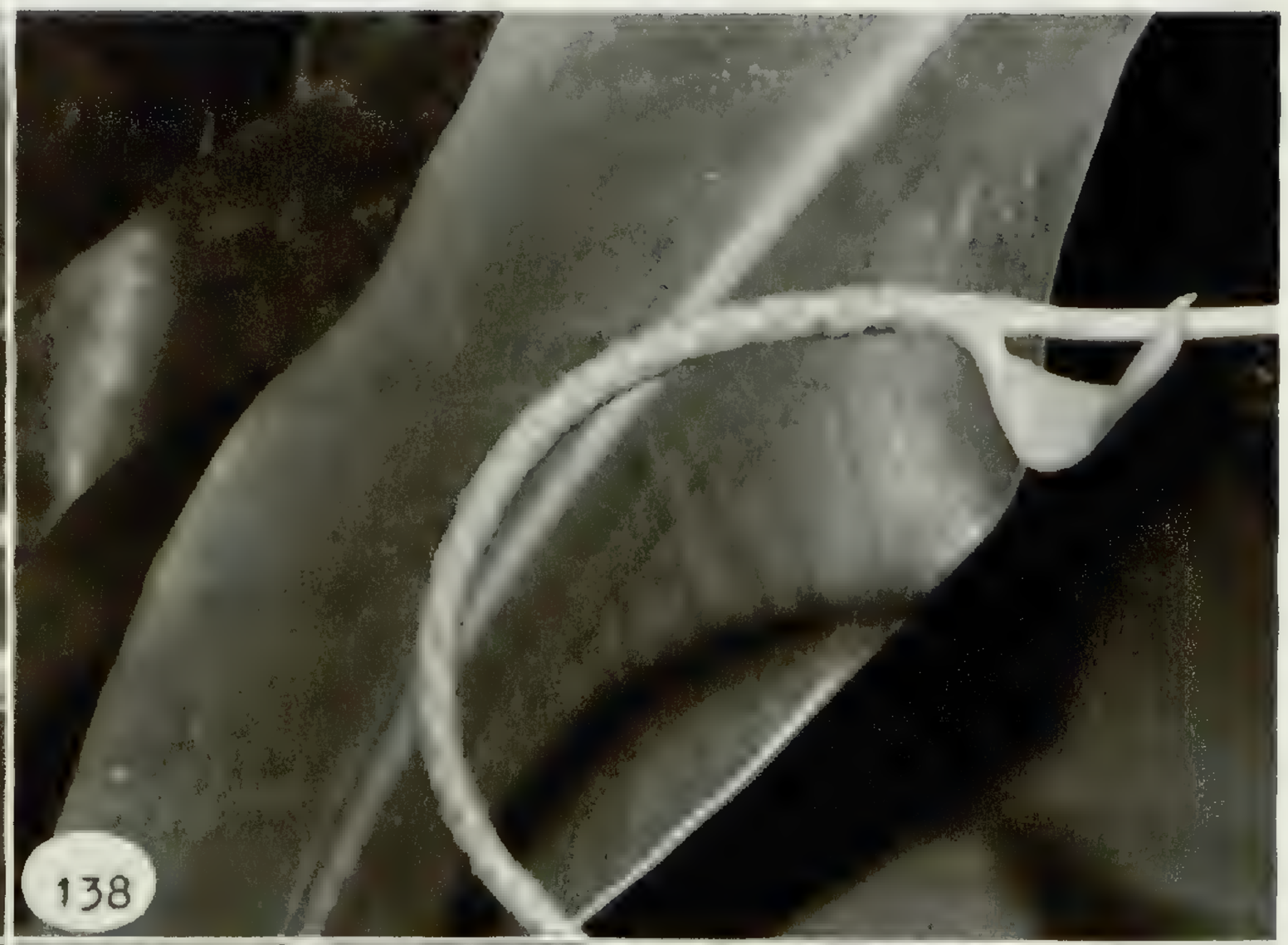
DARIÉN: Serranía de Pirre, vicinity Alturas de Nique, *Croat 37850, 37884, 37992, 37943, 37949* (MO), *37900* (F, GH, K, MO, PMA, SEL, US).

Anthurium pittieri Engl., Bot. Jahrb. Syst. 25: 372. 1898.

a. Anthurium pittieri var. **pittieri.** TYPE: Costa Rica. Heredia: Rancho Flores, Volcán Barba, 2,050 m, *Pittier & Durand 865* (BR, hololectotype; designated by Croat & Baker, 1979).

Epiphyte, sometimes somewhat scandent; stems less than 30 cm long; cataphylls drying dark tan, persisting intact, ultimately deciduous; petioles 3–15 cm long, 4–7 mm diam., subterete, usually bluntly sulcate to weakly flattened; blades narrowly lanceolate to lanceolate-elliptic to ovate-elliptic or oblong, moderately thick, (8.5–)10–43 cm long, 1.5–9 cm wide, acute to obtuse or rarely rounded at base. Inflorescence more or less erect; peduncle (5–)11–14 cm long; spathe green, subcoriaceous, oblong-lanceolate, (3–)7–15 cm long, 1.2–2.5 cm wide; berries yellow to orange in Panama or reportedly white in Costa Rica, obovoid, acute at apex, 1–1.5 cm long, 7 mm diam.; seeds 2. See Croat (1983: 349) for a more complete description.

The species is known from Costa Rica and Panama at 50 to 2,100 m in premontane wet, tropical wet, and premontane rain forest life zones. A specimen recently collected by Ernesto Ancuash (*1230*) under the auspices of Brent Berlin's anthropological studies in Peru (Dept. of Amazonas, Río Cenepa) is possibly also this species. If so, it would be the first collection of the species from South America.



FIGURES 137–140. 137, 138. *Anthurium pirrense* Croat, *Croat 37900.*—139. *Anthurium protensum* ssp. *arcuatum* Croat, *Croat 48964.*—140. *Anthurium protensum* ssp. *arcuatum* Croat, *Croat 33138.*

Anthurium pittieri is a member of section *Oxycarpium* and is distinguished by its coriaceous, epunctate leaf blades, its premature emergent berries, and especially by its long-decurrent spathe.

Anthurium pittieri consists of two varieties in Panama. Variety *pittieri* has a broader elevational range extending from near sea level to about 2,000 m (averaging 800 m), while variety *morii* is consistently higher, ranging from 750 to about 2,000 m (averaging 1,200 m). Variety *morii* differs in having longer internodes (usually more than 1.5 cm long), more ovate blades, mostly about three times longer than broad (1.8–3.7 times longer than broad with only seven to nine moderately prominent (on drying) primary lateral veins. In contrast, variety *pittieri* usually has 13 to 20 primary lateral veins that dry moderately obscure.

CHIRIQUÍ: vicinity Los Planes de Hornito, *Antonio 2854* (MO).

COCLÉ: Alto Calvario, *Folsom 2337, 6198* (MO); Cerro Pilón, *Liesner 781* (MO); vicinity El Copé, *Hammel 957, 6273* (MO), *4161* (MO, SEL); vicinity El Valle, *Hammel 7175* (MO), *Luteyn & Kennedy 1662* (DUKE); La Mesa, *Croat 37325* (MO).

COLÓN: Río Guanche, *Croat 37025* (MO), *Mori & Witherspoon 7967* (MO).

PANAMÁ: Cerro Campana, *Croat 14766* (MO), *35981* (K, MO, PMA, RSA, US), *17241* (BR, MO, RSA), *Kirkbride 252* (MO), *Lewis et al. 3045* (MO), *Luteyn & Kennedy 1833* (DUKE), *Luteyn 3190, 3195* (DUKE), *Mori & Kallunki 2482* (MO), *Stimson 5401* (NY), *Sytsma 2923, 2931, 2933, 2975, 3536* (MO); El Llano-Cartí Road, *Dressler 4637* (F).

VERAGUAS: Cerro Tute, *Antonio 1830* (MO), *Sytsma & Antonio 2982* (K, MO), *Sytsma & Andersson 4711* (MO), *Witherspoon et al. 8891* (MO); vicinity Escuela Agricola Alto Piedra, *Antonio 3970* (MO), *Croat 48916* (MO, PMA); valley of Río Dos Bocas, *Croat 27635* (MO); vicinity Santa Fe, *Folsom 2937* (MO), *Hammel 4591* (MO), *Mori & Kallunki 3069* (MO), *Mori et al. 3987* (MO).

b. Anthurium pittieri var. **morii** Croat, var. nov. TYPE: Panama. Coclé: Alto Calvario cloud forest along Continental Divide above sawmill, 5.2 mi. N of El Copé, 930 m, *Croat 49180* (MO 2727064, holotype; K, PMA, SEL, isotypes).

Planta scandens, epiphytica aut terrestris; internodis 1–8.5 cm longis; cataphyllum membranaceum findens in fibris tenuibus, pallidibus; petiolus subteres, (0.5–)1–7(–11) cm longus; lamina siccitate modice membranacea et denigrata, ovata, interdum elliptica aut oblongo-elliptica, basi acuta ad raro obtusa; inflorescentia foliis breviora; pedunculus teres, 2–9 cm longus; spatha viridis, membranacea, oblongo-lanceolata, 2.2–4 cm longa, 6–10 mm lata, decurrens 1–1.5 cm; stipite 2–17 mm longo; spadix viridis, 1–4 cm longus; baccae luteae ad pallide aurantiacae, obovoideae, 10–11 mm longae, 6–7 mm diam.

Scandent, epiphytic or terrestrial; internodes 1–8.5 cm long (mostly 1.5–2); leaf scars inconspicuous; roots slender, relatively numerous at the lower nodes, few or none from the upper nodes; cataphylls thin, ensheathing stem, narrowly rounded and subapically apiculate at apex (the apiculum 1–5 mm long), promptly weathering to pale thread-like fibers or deciduous, sometimes with the thickened basal portions persisting at the upper nodes. LEAVES scattered along the upper part of the stem; petioles (0.5–)1–7(–11) cm long, subterete, narrowly flattened adaxially, sometimes the margins weakly raised; blades usually ovate, sometimes elliptic or oblong-elliptic, drying moderately thin, gradually acuminate at apex (the acumen flat, inrolled minutely) acute to rarely obtuse to attenuate at the base, 7–14 cm long, 2–7.3 cm wide, broadest usually at the middle or in the lower third; drying dark brown to blackened; both surfaces semiglossy, the lower surface often much paler; midrib weakly raised above, almost flat below, darker than the surface, drying raised; primary lateral veins 7–11 per side, departing midrib at 35–55° angle, moderately straight to the collective vein, moderately obscure on fresh blades, drying prominulous at least on lower surface, sometimes paler than the surface above on dried leaves; scarcely more prominent than the interprimary veins; lesser veins not visible; collective vein arising from the base, 2–6 mm from the margin, drying prominulous on lower surface. INFLORESCENCE mostly from the uppermost leaf axils, usually shorter than leaves; peduncle terete, 2–9 cm long, 1–2 mm diam., usually to 2 times longer than the subtending petiole; spathe green, moderately thin, oblong-lanceolate, 2.2–4 cm long, 6–10 mm wide, broadest just above the base, narrowly acuminate to narrowly rounded and cuspidate at apex, acute at base and decurrent 1–1.5 cm, inserted at 20–30° angle to the peduncle; stipe 2–17 mm long; spadix slender, gradually tapered toward apex, green, 1–4 cm long, 2–3 mm diam. near the base, 1–2 mm diam. near apex; flowers square, 3.1–3.3 mm wide in both directions, 2–3 flowers visible in the principal spiral, 3–4 flowers visible in the alternate spiral; tepals semiglossy, the lateral tepals 2–2.3 mm wide, the inner margin broadly rounded, the

alternate pair with the inner margin concave; pistil usually weakly raised; stamens held at the level of the tepals in a relatively close circle around the pistils (the intervening space narrower than the anthers); anthers 0.4 mm long, 0.8 mm wide (dried); the thecae subrounded. INFRUCTESCENCE with berries yellow to pale orange, obovoid, 10–11 mm long, 6–7 mm diam., rounded at apex; seeds broadly ovoid, flattened, truncate to broadly sunken at apex, rounded at the base, surrounded on 3 sides by a gelatinous, sticky substance. Figs. 111 and 112.

Anthurium pittieri var. *morii* is endemic to western Panama from Chiriquí and Bocas del Toro Provinces to Coclé at mostly 900 to 2,066 m in premontane and lower montane rain forest life zones.

It is distinguished by its scandent habit with slender stems, its elongate internodes, its leaves that dry somewhat blackened, and by its prominently decurrent spathe, prominently stipitate, green spadix, and obovoid yellow to pale orange berries. Variety *morii* is similar to *A. carnosum,* which has similar leaves and long internodes, but that species differs in having a spathe that is not at all decurrent. The variety can also be confused with *A. interruptum,* another scandent species with elongate internodes and leaves that also dry blackened, but the latter species lacks the decurrent spathe, has reddish berries, and its stems have an elongate internode alternating with two or more short internodes.

This variety is named in honor of Dr. Scott Mori who made the first collection.

CHIRIQUÍ/BOCAS DEL TORO: Cerro Colorado, *Folsom 6130* (MO).

CHIRIQUÍ: NE of Boquete, *Hammel 5712* (MO); Cerro Colorado, *Antonio 1435* (MO), *Croat 37249* (MO), *Mori & Dressler 7891* (MO), *Sullivan 394* (MO); above San Félix, *Croat 33130* (MO).

COCLÉ: Alto Calvario, *Croat 49180* (MO, PMA), *Folsom & Robinson 2410* (F, MO, PMA), *Folsom & Jaslon 2682* (MO); vicinity El Copé, *Croat 44552* (MO), *Hammel 3565* (MO); El Potroso, *Folsom & Collins 1545* (MO).

VERAGUAS: Cerro Tute, *Mori 6745A* (MO).

Anthurium platyrhizum Croat, sp. nov. TYPE: Panama. Colón: along drainage of Río Gatún, *Antonio 3853* (MO 2801415, holotype; PMA, isotype; Live at K, MO).

Planta epiphytica; radices camplanatis; cataphyllum coriaceum subpersistens; petiolus leviter camplanatus ad leviter sulcatus, 4–11 cm longus; lamina anguste elliptica ad oblanceolato-elliptica, basi acuta ad obtusa aut rotundata, 17–30 cm longa, 4.3–8.7 cm lata; inflorescentia effusa; pedunculus 10.5–26 cm longus, teres; spatha subcoriacea, viridis, ovata, 2.6–4.5 cm longa, 1.5–2 cm lata; spadix atrovirens, 1.6–3.5 cm longus; baccae violaceo purpureae, ovoideae, ca. 8 mm longae.

Epiphyte; stems very short, green; leaf scars ca. 8 mm wide; roots dense, greenish brown, flat, 5–8 mm wide; cataphylls coriaceous, 1.5–3.7 cm long, drying brown with a raised medial rib, acute and apiculate at apex, the apiculum ca. 1.5 mm long, drying tan (B & K Yellow 6/5), splitting at base, intact at apex, subpersistent. LEAVES spreading; petioles 4–11 cm long, 2–3 mm diam., weakly flattened to shallowly sulcate adaxially; geniculum 1–1.7 cm long; blades narrowly elliptic to oblanceolate-elliptic, acuminate at apex, acute to obtuse or rounded at base, 17–30 cm long, 4.3–8.7 cm wide, broadest at the middle; upper surface matte to semiglossy, lower surface semiglossy; midrib weakly raised at base above, diminished and sunken at apex, prominent and convexly raised below; primary lateral veins 4–6 per side, departing the midrib at 45–55° angle, flat to weakly sunken above, nearly obscure in older leaves, prominulous below, more or less straight to collective vein; lesser veins obscure above, flat below; collective vein arising from near the base, sometimes extending along midrib at base for up to 2 cm before branching out to form collective vein, 0.4–1 cm from margin, sunken above, raised below. INFLORESCENCE spreading, usually shorter than leaves; peduncle 10.5–26 cm long, 2–3.5 mm diam., terete, 2–5 times longer than petioles; spathe subcoriaceous, green (B & K Yellow-green 6/7.5), ovate 2.6–4.5 cm long, 1.5–2 cm wide, broadest just below middle, abruptly acuminate at apex, rounded to acute at base; stipe pale green, 1–1.7 cm long, 2–4 mm diam.; spadix dark green (B & K Green 5/2.5), scarcely tapered at apex, 1.6–3.5 cm long, 5–8 mm diam. midway, the flowers 4-lobed, 4–4.5 mm long, 5–5.5 mm wide, the sides jaggedly sigmoid, 3–4 flowers visible in the principal spiral, 4–5 flowers visible in the alternate spiral; tepals glossy with obscure, pale punctations, minute droplets apparent at anthesis, lateral tepals ca. 2 mm wide, the inner margin weakly rounded; pistils emergent ca. 1 mm, whitish, translucent, pointed, sometimes tinged violet purple near edges of tepals; stigma broadly elliptic, 0.5–0.6 mm long, with small clear droplets apparent 1–2 days before stamens emerge; stamens emerging

beginning from the base, laterals first, emerging to midway before alternates emerge, exserted on short, translucent filaments, retracting and held at edge of tepals in a close but noncontiguous circle around pistil; anthers yellow, ca. 0.6 mm long, 0.5 mm wide; thecae oblong, slightly divaricate; pollen bright orange fading to pale orange to tan. INFRUCTESCENCE with berries ovoid, ca. 8 mm long, 4 mm diam., violet purple, rounded at apex; seeds not seen. Figs. 141, 142, and 145.

Anthurium platyrhizum is known only from Panama (though it is to be expected in Colombia) and has been collected from the Atlantic slope in the Provinces of Colón and San Blas from near sea level to 600 m in premontane and tropical wet forest.

The species was first collected by Helen Kennedy who sent living material of the species to Kew Gardens where it set fruit. Living material was later sent to the Missouri Botanical Gardens by Tom Antonio. It is recognized by narrowly elliptic, epunctate leaf blades and the dense mass of conspicuously flattened roots (hence the name *platyrhizum*). Other distinguishing features include its green, boat-shaped, acuminate spathe, its dark green, short-cylindroid spadix with markedly raised tepals, its prominently exserted style, and its violet purple berries.

Anthurium platyrhizum is most closely related to *A. llanense* ssp. *llanense,* which has similar leaves and flowers; the latter taxon, however, has a more or less globose spadix, regular, slender, terete roots, and has the collective vein arising from very near the base of the leaf. In *A. platyrhizum,* the collective veins extend upward along the midrib for some distance from the base before diverging as the collectives.

Anthurium platyrhizum is also closely related to *A. wedelianum,* which has very similar leaves but has a much longer, tapered spadix, has flowers that are not markedly raised, and lacks deep channels between the tepals.

The sectional placement of all the above species is in doubt, but they have been tentatively placed in section *Urospadix.*

COLÓN: Río Gatún, *Antonio 3853* (MO, PMA); ridge between Río Piedras & Río Gatún, *Sytsma et al. 4306* (MO); Santa Rita Ridge, *Kennedy 2730* (F, K, MO), *Knapp et al. 1731* (MO).

SAN BLAS: on trail to Darién from Puerto Obaldía, *Mori et al. 6861* (MO).

Anthurium pluricostatum Croat & Baker, Brenesia 16(Supl. 1): 68. 1979. TYPE: Costa Rica. Limón: ca. 1 mi. NE of Bribri, ca. 40 mi. SW of Limón (on coastal road), steep ravine above Río Catarata, 50–100 m, *Croat 43243* (MO 2584480–81, holotype; CR, F, K, RSA, US, isotypes; Live at MO).

Terrestrial; stem 2.5–3 cm diam., to 23 cm long; cataphylls turning brown and weathering into a dense mass of persistent, coarse fibers; petioles 26–68 cm long, 6–8 mm diam., subterete, narrowly flattened to weakly and obscurely sulcate adaxially, almost smooth to characteristically several ribbed or striate around the circumference; blades narrowly ovate, moderately thin, deeply lobed at base, 40–68 cm long, 20–38 cm wide. Inflorescence erect-spreading; peduncle 17–43 cm long, 4–5 mm diam., terete to obscurely angular, sometimes heavily suffused with dark purple; spathe subcoriaceous, pale violet purple or green slightly suffused throughout with violet purple, especially on the inner surface, oblong-lanceolate, 13–18.5 cm long, 2–3.7 cm wide; stipe 3 mm long; spadix pale lavender or green tinged with pale lavender, yellowish green near the tip or sometimes pale reddish purple throughout; berries purplish in upper one-third, white in lower two-thirds; seeds 2. See Croat (1983: 351) for a more complete description.

The species is known from Costa Rica and in Panama in Colón Province and in Chiriquí Province on the Burica Peninsula. It is certainly to be expected in Bocas del Toro Province as well. It occurs in premontane wet transition forest and premontane wet and tropical wet forest at elevations from near sea level to 1,000 m on both the Pacific and Atlantic slopes.

Anthurium pluricostatum, a member of section *Belolonchium,* is characterized by its terrestrial habit, its subterete petiole with seven to ten low ridges, and by its spadix that is lavender to reddish purple or green tinged with lavender, usually with a discolorous yellowish green portion near the apex. The species is also unusual in having flowers with stigmatic droplets persisting while the stamens emerge.

CHIRIQUÍ: Burica Peninsula, W of Puerto Armuelles, *Busey 715* (MO), *Croat 35063* (MO, PMA), *Liesner 78, 441* (MO).

COLÓN: Río Guanche, *Antonio 4805* (MO).

FIGURES 141–144. 141, 142. *Anthurium platyrhizum* Croat, *Antonio 3853*.—143, 144. *Anthurium rotundistigmatum* Croat, *Croat 37745*.

FIGURES 145–148. 145. *Anthurium platyrhizum* Croat, *Antonio 3853*. — 146. *Anthurium supraglandulum* Croat, *Croat 49087*. — 147, 148. *Anthurium tutense* Croat, *Croat 48951*.

Anthurium protensum Schott, Oesterr. Bot. Z. 8: 181. 1858.

Anthurium protensum ssp. **arcuatum** Croat, ssp. nov. TYPE: Panama. Chiriquí: above San Félix along mining road, ca. 25 mi. off Pan-American Hwy. (above turnoff to Escopeta), ca. 1,500 m, *Croat 33138* (MO 231113, holotype; F, K, PMA, US, isotypes; Live at MO).

Anthurium protensum ssp. *arcuatum* differt lamina minori venis primariis lateralibus paucioribus, spatha ovata, spadice erecto-breviori.

Usually epiphytic; stems 1.8 cm diam., roots directed downward; cataphylls 3.4–7 cm long, coriaceous, acuminate at apex (acumen apiculate), drying tan (B & K Yellow 5/5), persisting intact, subsequently weathering into reticulate fibers. LEAVES spreading; petioles 10–32 cm long, 3–4 mm diam., bluntly angled or rounded abaxially, flattened to weakly sulcate adaxially; geniculum 1–1.5 cm long; blades oblong or narrowly oblanceolate, gradually acuminate at apex, obtuse to rounded at base, 19–51 cm long, 2.5–6 cm wide, broadest at middle and below; both surfaces semiglossy to glossy, the midrib bluntly raised above, sunken at apex; acutely raised below; primary lateral veins 7–11 per side, departing midrib at 50° angle, sunken in valleys above, raised below, weakly arching to collective vein, interprimary veins scarcely visible, sunken above, raised below, collective vein arising from base, 3–5 mm from margin, sunken above, raised below. INFLORESCENCE erect to spreading, shorter than leaves; peduncle 13–38 cm long, 2–4 mm diam., pale green sometimes tinged with reddish violet, terete or 1-ribbed abaxially, one-half to 2 times longer than petioles; spathe green sometimes heavily tinged reddish violet (B & K Red-purple 3/10), ovate to broadly lanceolate, 4.5–6.5 cm long, 1.8–3 cm wide, caudate or short-acuminate at apex, rounded to subcordate at base, broadest at base, inserted at 70° angle on peduncle, curved over and hooding spadix, briefly decurrent on peduncle; stipe 2–3 mm long, 2 mm diam., sometimes tinged red-violet; spadix weakly curved, lavender (B & K Purple 7/7.5) or pale green, 2–4 cm long, 5–6 mm diam. at base, 3–4 mm diam. at apex, the flowers rhombic to 4-lobed, 2–3 mm long, 2.3–2.8 mm wide, the sides jaggedly sigmoid, 4–5 flowers visible in the principal spiral, 5–8 flowers visible in the alternate spiral; tepals matte with dense papillae, lateral tepals 1–1.7 mm wide, the inner margin convex; pistils scarcely emergent, pale green, papillate; stigmas 0.3–0.4 mm long, elliptic, with small droplets briefly apparent before first stamens emerge, then moist with minute brush-like papillae; stamens emerging from the base, both lateral stamens emerged before opening, alternate stamens following quickly, pollen pale yellow fading to creamy white, defusing over tepals leaving brown, ellipsoid, slightly divaricate thecae, anthers pale yellow, 4–5 mm long, 9–10 mm wide, curved over edge of pistil. INFRUCTESCENCE pendent to 7 cm long, 2.5 cm diam. (with berries exserted); berries bright orange, ovoid with a quadrangular beak, 8–9 mm long, 5–6 mm diam.; mesocarp pulpy; seeds 2, creamy white, ovoid-ellipsoid, 3–3.2 mm long, 2.2–2.3 mm diam., 1.5 mm thick, enveloped by a clear, sticky envelope, ca. 5 mm long, protruding further beyond the apex than the base. Figs. 139 and 140.

Anthurium protensum ranges from Costa Rica to Panama. Subspecies *arcuatum* is known only from western Panama in premontane rain forest at elevations of 1,200 to 2,000 m.

This is a member of section *Pachyneurium* and it is distinguished by its slender, short stem, its more or less oblong leaf blades that are usually spreading and weakly arched, and by its usually arched inflorescence (thus the name *arcuatum*). Also characteristic are its usually lavender, greenish white or purplish violet spadix and its ovate to broadly lanceolate, frequently purplish spathe that usually curves over and hoods the spadix.

The few cultivated collections of *Anthurium protensum* ssp. *protensum* and ssp. *arcuatum* are markedly different, but herbarium material is more difficult to separate. Subspecies *protensum* differs from ssp. *arcuatum* in having typically much larger leaf blades, rarely less than 50 cm long, with the primary lateral veins more numerous and less conspicuously sunken on upper surface (scarcely more prominently sunken than the interprimary veins). In addition, the lower midrib is convex and the plant typically has a lanceolate spathe, a much longer, narrowly tapered spadix, usually more than 9 cm long, and an infructescence usually 20–30 cm long. Subspecies *protensum* is also usually a pendent or near pendent plant, whereas ssp. *arcuatum* is erect.

Subspecies *arcuatum* rarely has leaf blades

more than 50 cm long, relatively fewer, sharply sunken primary lateral veins, an acutely raised lower midrib, a typically ovate spathe, with a spadix usually less than 5 cm long, and the infructescence less than 7 cm long.

BOCAS DEL TORO: ENE of Cerro Pata de Macho, *Hammel 6136, 6254* (MO).

CHIRIQUÍ: Boquete, *Pittier 3062* (US); Cerro Colorado, *Croat 33138* (F, K, MO, PMA, US), *33369, 48461* (MO), *Folsom et al. 4693* (MO), *Mori & Dressler 7770* (MO); Cerro Horqueta, *Dwyer 8749* (DUKE), *Pittier 3160* (NY), *3161* (US); vicinity Cerro Punta, *Wilbur et al. 13081, 15235, 15236, 15252, 15377* (DUKE); valley of upper Río Chiriquí Viejo, vicinity Monte Lirio, *Seibert 172* (K, NY).

VERAGUAS: slopes of Cerro Tute, *Croat 48964* (MO), *Folsom & Mauseth 8344* (MO).

Anthurium pseudospectabile Croat, sp. nov. TYPE: Panama. Chiriquí: along road between Gualaca and Fortuna Dam site, 8.3 mi. NW of Los Planes de Hornito, 1,260 m, virgin forest, 82°16′W, 8°44′N, *Croat 49942* (MO 2769003–005, holotype; PMA, isotype; Live at MO).

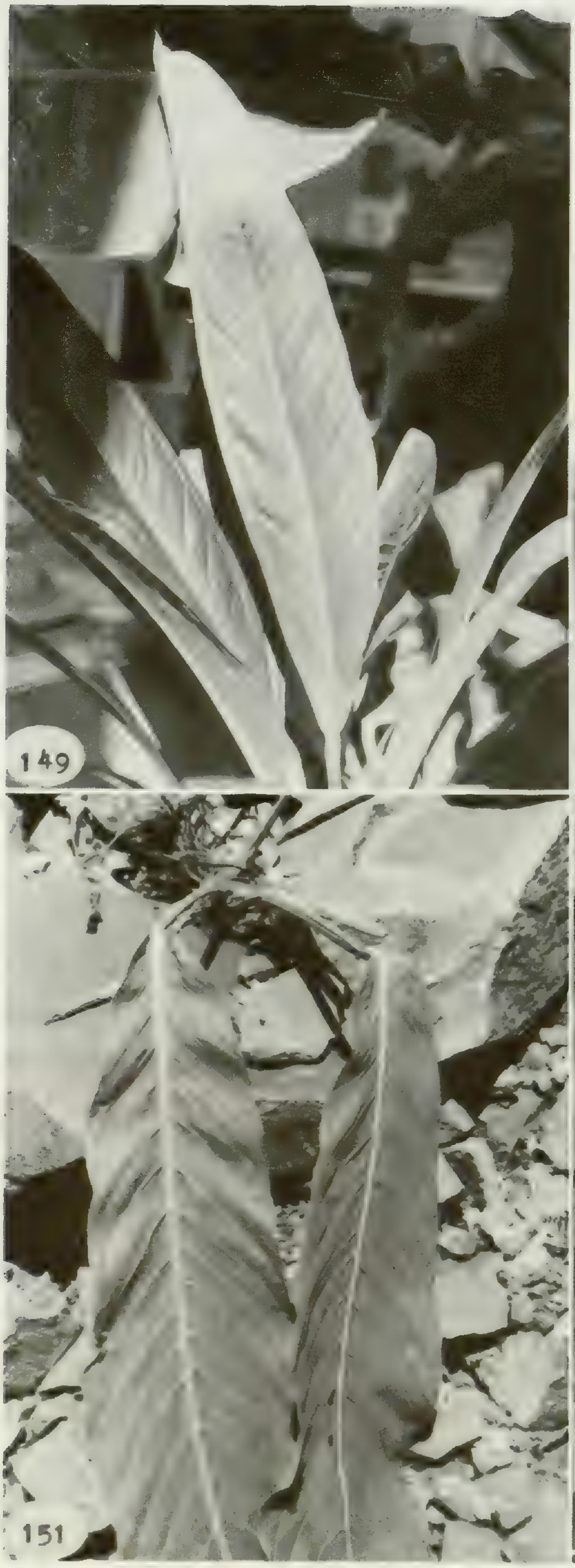
Planta plerumque pendula epiphytica; cataphyllum subcoriaceum; basi findens, fibris, apice persistens intactum; petiolus subteres, complanatus ad leviter lateque sulcatus adaxiale, interdum obtuse quadrangulatus, 14–60 cm longus; lamina modice coriacea, oblonga ad oblongo-elliptica, basi obtusa ad rotundata, 65–150 cm longa, 12–45 cm lata, nervis primariis lateralis usque 40; inflorescentia effusa; pedunculus teres ad leviter quadrangulatus, 13–36 cm longus; spatha coriacea, pagina inferiore viridis, pagina superiore tincta purpurea, lanceolata, plerumque torta aut circinata, 10–32 cm longa, 2.5–7 cm lata; spadix sessilis, flavovirens aut viridis, 15–38 cm longus, praecox emergenti pistillo; baccae aurantiacae, oblongo-ellipsoideae, 10–12 mm longae.

Usually pendent epiphyte; stems less than 30 cm long, 2–5 cm diam.; leaf scars 2–4 cm wide; roots few, thick, ca. 6 mm diam.; cataphylls subcoriaceous, 31–37 cm long, more or less rounded to obtuse at apex, with subapical apiculum to ca. 4 mm long, drying tan, splitting to fibers at base, the apex persisting intact. LEAVES pendent; petioles subterete, flattened to weakly and broadly sulcate adaxially to bluntly 4-sided, 14–60 cm long, 7–12 mm diam.; geniculum 1–3 cm long; blades moderately thick, oblong to oblong-elliptic, gradually acuminate at apex, obtuse to rounded at base, 65–150 cm long, 12–45 cm wide, broadest at middle or just below; upper surface matte to semiglossy, lower surface semiglossy, only slightly paler than upper surface; midrib flat to obtusely raised near base above, diminishing toward apex, convexly raised below; primary lateral veins up to 40 per side, departing midrib at 35–40° angle, straight or weakly arching to collective vein, raised above and below, conspicuously paler than surface; interprimary and secondary veins less conspicuous, flat; collective vein arising near the base, 2–3 mm from margin, raised above and below. INFLORESCENCE spreading-pendent; peduncle terete to weakly quadrangular, the margins blunt, 13–36 cm long, 5–9 mm diam., equalling to one and a half times longer than petioles; spathe moderately thick, green on lower surface, heavily tinged purple on upper surface, lanceolate, 10–32 cm long, 2.5–7 cm wide, broadest near the base, gradually acuminate at apex, rounded to cordate at base, inserted at 45–60° angle on peduncle, usually twisting or coiling; spadix sessile, yellowish green to green, 15–38 cm long, 8–12 mm diam. at apex, 3–5 mm diam. at base, narrowly tapered toward apex; flowers rhombic, ca. 3.5 mm long, 2.7–3 mm wide, the sides straight to weakly sigmoid, 4–7 flowers visible in the principal spiral, 6–9 flowers visible in the alternate spiral; tepals matte, minutely papillate, lateral tepals 1.8–2 mm wide, the inner margins convex, turned up against pistil; pistils early emergent, pale green; stigmas linear, ca. 0.6 mm long, tinged purplish; stamens emerging more or less rapidly from base, exserted on filament ca. 0.3 mm long, ca. 0.5 mm wide; anthers white, held around pistil in a loose cluster; thecae oblong, scarcely divaricate; pollen white. INFRUCTESCENCE pendent; berries orange, early emergent, oblong-ellipsoid, 10–12 mm long, 5–6 mm diam. Figs. 151 and 152.

Anthurium pseudospectabile is endemic to Chiriquí Province in western Panama (Fortuna Dam area) at 1,250 to 1,500 m in a region that is probably premontane wet or premontane rain forest.

The species is a member of section *Pachyneurium* and is distinguished by its pendent habit and its elongate, many-veined blades with undulate margins. Also characteristic are its short-pedunculate inflorescence with a spreading, usually twisted and contorted green to purple spathe, its weakly protruding tepals, its exserted stamens, its early emergent pistils, and its orange berries.

Anthurium pseudospectabile is closely related to *A. spectabile* Schott from central Costa Rica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FIGURES 149–152. 149, 150. *Anthurium redolens* Croat, *Hammel 7235*.—151. *Anthurium pseudospectabile* Croat, *Croat 48674*.—152. *Anthurium pseudospectabile* Croat, *Croat 48777*.

to Nicaragua, but the latter is distinguished by having proportionately broader leaf blades, which generally lack the undulate margins and a petiole that is markedly quadrangular in cross-section.

CHIRIQUÍ: Fortuna Dam site, *Croat 48674* (CAS, CM, COL, DUKE, F, K, MEXU, MO, NY, PMA, RSA, UC, US, VEN), *48732, 48777, 49851* (MO), *Folsom 5516, 8220* (MO), *Folsom et al. 5607* (B, MO, VEN), *Hammel 2080* (MO, PMA), *Mendoza 336* (MO); vicinity Gualaca, *Antonio 5022* (MO); between Gualaca & Fortuna Dam site, *Croat 49930* (MO), *49942* (MO, PMA).

Anthurium purpureospathum Croat, Selbyana 5: 328. 1981. TYPE: Panama. Bocas del Toro: Station Milla 7.5 on Changuinola-Almirante Railroad, less than 100 m above sea level, along slender ridge to WWII communications facility, ca. 2 km NW of ruins of U.S. Army military barracks, *Croat 38094* (MO 2388335, holotype; B, CAS, CM, DUKE, F, GH, K, M, NY, PMA, RSA, S, SEL, US, VEN, isotypes; Live at MO).

Epiphytic or terrestrial at higher elevations; cataphylls drying dark tan, subpersistent, remaining intact as reticulate fibers; petioles 12–31 cm long, 4–10 mm diam., more or less quadrangular, flat to broadly and sharply sulcate, usually prominently 3-ribbed abaxially; blades oblong-oblanceolate to oblong-elliptic, coriaceous, obtuse to acute or attenuate at base, 27–74 cm long, 7.5–40 cm wide. Inflorescence erect; peduncles 3–38 cm long, 0.8–2 cm diam., purplish or green, subterete; spathe medium thick, purple to purplish with green mottling especially near base at center or green mottled with purple at anthesis, oblong to narrowly ovate, 4.5–17.5 cm long, 1.5–4 cm wide; spadix violet purple, (4–)5–22 cm long, 1–2.5 cm diam. at base; berries orange, red-orange to red, narrowly ovoid, acute at apex with a round, minute, mammilliform style; seeds 1 or 2. See Croat (1983: 358) for a more complete description.

The species is known only from Panama and occurs principally from near sea level to 200 m in Bocas del Toro Province in wetter parts of tropical moist and premontane wet forest. A population on Cerro Colorado, in tropical wet or premontane rain forest at 1,200 to 1,500 m appears to differ in no way from the populations at lower elevations except that it has thicker leaves and a consistently terrestrial habit. The terrestrial habit is not unusual for populations at higher elevations where a greater accumulation of debris exists and where the steeper slopes provide better drainage. The species should be expected at medium elevations as well.

Anthurium purpureospathum, a member of section *Pachyneurium,* is distinguished by its rosulate habit, its more or less oblanceolate leaf blades, its almost quadrangular petioles, often three-ribbed abaxially, its generally short peduncles, its usually violet purple reflexed spathe, its usually short violet purple spadix, its early emergent pistils, and by its long, sharply pointed, orange to red-orange berries.

BOCAS DEL TORO: vicinity Almirante, *Croat 38179, 38180* (MO), *38214* (MO, PMA), *D'Arcy 11207* (MO); S of Changuinola, *Lazor & Tyson 2661* (MO); Chiriquicito to S along Río Guarumo, *Lewis et al. 1985* (MO, NY); vicinity Chiriquí Lagoon, *Wedel 2721* (GH, MO); Isla Colón, *Wedel 125* (MO), *569* (GH, MO); Río Cricamola, *Woodson et al. 1889* (MO, NY); vicinity Railroad Station at Milla 7.5, *Croat & Porter 16416* (MO), *Croat 38094* (B, CAS, CM, DUKE, F, GH, K, M, MO, NY, PMA, RSA, S, SEL, US, VEN); Water Valley, *Wedel 708* (MO), *774* (GH, MO).
CHIRIQUÍ: Cerro Colorado, *Croat 33257* (MO, PMA), *48483* (MO), *Folsom 1835* (MO); above San Félix along mining road, *Croat 33139* (MO).

Anthurium ramonense Engl. ex K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 11: 611. 1932. TYPE: Costa Rica. Alajuela: at San Ramón, 1,200 m, *Tonduz 17703* (B, holotype; CR, isotype).

Anthurium isonervium Standl. & L. O. Wms., Ceiba 3: 104. 1952. TYPE: Nicaragua. Dept. Río San Juan: San Juan del Norte (Greytown), sea level, *Charles Smith 61* (EAP, holotype; MO, US, isotypes).

Epiphytic; stems short; cataphylls drying brown, weathering into fibers and persisting at base of leaves; petioles subterete, narrowly and bluntly sulcate, 4–20 cm long, 4–10 mm diam.; blades elliptic to broadly elliptic to obovate or oblanceolate, moderately thick, 22–54 cm long, 9.5–24 cm wide, acute to obtuse at base. Inflorescence spreading-pendent; peduncle 9–36 cm long, 3–9 mm diam., sometimes tinged reddish violet, conspicuously ribbed beneath opening of spathe; spathe coriaceous, yellow-green sometimes suffused with purple, lanceolate or oblong, 6–12 cm long, 1.5–2.8 cm wide; spadix green, tinged red-violet in later stages, 13–36 cm long, 5–11 mm diam. at base; berries pale red to dark violet purple (B & K Purple 3/7.5) sometimes pale lavender to white, flat at apex, 3–4 mm long,

emerging a few at a time. See Croat (1983: 359) for a more complete description.

The species is known from Nicaragua to Panama from sea level to 1,400 m in wetter parts of tropical moist forest and in premontane wet, tropical wet, premontane rain, and lower montane wet forest life zones. In Panama, the species is most abundant on the Atlantic slope but occurs also on the Pacific slope near the Continental Divide.

Anthurium ramonense is a member of section *Porphyrochitonium* and can be distinguished from other glandular-punctate species by its proportionally shorter, stouter petioles, its generally larger blades, and by its long, tapered, generally stout inflorescence. Fruit color is highly variable, so much so in fact as to place some doubt on the placement of certain collections. One collection (*Croat 33984*) produced mature fruits that were pale lavender, fading to white, while another (*Croat 48913*) had mature fruits that were dark violet purple.

BOCAS DEL TORO: vicinity Bocas del Toro at Maccaw Hill, *Wedel 558* (GH, MO).

CANAL ZONE: along Río Indio de Gatún, *Pittier 2796* (US).

COCLÉ: N of El Copé, *Croat 44740* (MO); Coclecito Road, *Hammel 2541* (MO); road from La Pintada to El Copé, *Hammel 2630* (MO).

COLÓN: near Guásimo, *Croat 9984* (MO, NY); Río Guanche, *Antonio 4766* (MO), *Croat 26180* (MO), *Kennedy & Foster 2153* (MO), *Knapp 1012* (MO), *Mori & Kallunki 5214* (MO), *Mori & Witherspoon 7981* (MO), *Sytsma 1625* (MO); vicinity Río Indio on road from Portobelo to Nombre de Dios, *Croat 33634* (MO); ridge between Río Piedras & Río Gatún, *Sytsma et al. 4297* (MO, PMA).

DARIÉN: Cerro Mali, *Gentry & Mori 13858* (MO); NE of Jaqué, *D'Arcy & Sytsma 14470* (MO); Río Mortí, *Duke 14127* (MO, NY); Serranía de Pirre above Cana gold mine, *Croat 37740, 37754* (MO); vicinity El Real, *Duke 4830* (MO), *Reveal & Duke 4888* (MO); Tres Bocas, *Kirkbride & Duke 1372* (MO); vicinity Tyler Kittredge gold mining camp, *Croat 27099* (MO, PMA).

PANAMÁ: Cerro Jefe, *Croat 49097* (MO); El Llano-Cartí Road, *Croat 33688, 33772, 49122, 49143* (MO), *Folsom et al. 5777* (MO), *Gentry 5817* (GH, MO), *Sytsma 970, 1737* (MO), *Tyson & Nee 7354* (MO); Serranía de Maje, S of Ipetí, *Knapp et al. 4471* (MO).

SAN BLAS: Aila Tiwar, *Sugden 428* (MO).

VERAGUAS: on road to Calovébora, *Croat & Folsom 33882, 33982, 34138* (MO), *33984* (MO, PMA); Cerro Tute, *Mori 6242* (MO); valley of Río Dos Bocas, *Croat 27632* (MO); vicinity Santa Fe, *Croat 48913, 49047* (MO).

Anthurium ranchoanum Engl., Bot. Jahrb. Syst. 25: 421. 1898. TYPE: Costa Rica. Rancho Flores in territorio Bacha, Volcán Barba, 2,100 m, *Pittier 2295* (B, holotype; BR, G, isotypes).

Anthurium valerii Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 137. 1937. TYPE: Costa Rica. Heredia:Vara Blanca, *Valerio 1600* (F, holotype).

Anthurium vinicolor Standl. & L. O. Wms., Ceiba 3: 106. 1952. TYPE: Costa Rica. San José: Cordillera de Talamanca near El Copey, cloud forest, 1,800 m, 23 Apr. 1949, *Williams 16538* (EAP, holotype; F, US, isotypes).

Epiphytic or terrestrial; cataphylls drying tan, persisting as coarse linear fibers; petioles subterete, shallowly and bluntly sulcate, 11–79 cm long, 5–15 mm diam.; blades narrowly ovate or ovate-deltoid, moderately thick, shallowly to deeply lobed at base, 17–64 cm long, 10–34 cm wide. Inflorescence erect-spreading to pendent, peduncle 13–56 cm long; spathe narrowly ovate, green, tinged with purple on inner surface, 4–35 cm long, 2–6.5 cm wide; spadix sessile or with stipe to 2.5 cm long, dark purple, 3.5–19 cm diam. at base; berries orange, narrowly obovoid, to 14 mm long. See Croat (1983: 360) for a more complete description.

Anthurium ranchoanum is found in Costa Rica and Panama at elevations of 500 to 2,300 m (usually above 1,000 m), usually in tropical wet, premontane rain, and lower montane rain forest life zones.

The species, an atypical member of section *Pachyneurium*, is recognized by its obtusely sulcate petioles and thick, ovate to ovate-triangular blades with heavy, rather numerous veins. Particularly characteristic is its ovate to lanceolate, green tinged with purple, hooding spathe that remains stiffly erect. Other distinguishing features include its dark violet purple, relatively stubby, scarcely tapered, somewhat pendent spadix with tight clusters of white stamens and its orange berries.

CHIRIQUÍ: Cerro Hornito, *Hammel 6217* (MO), *Folsom et al. 7224* (MO); Cerro Horqueta, *Cochrane et al. 6264* (MO, WIS), *Dwyer et al. 545* (GH, MO, US); Cerro Pando, *Knapp 1653* (K, MO); Cerro Pata de Macho, *Croat 48519A, 48553* (MO), *Sytsma et al. 4949* (MO); La Fortuna, *Hammel 2113* (MO); between Gualaca & Fortuna Dam site, *Croat 49846* (MO); vicinity of Las Nubes, *Liesner 326* (MO).

Anthurium ravenii Croat & Baker, Brenesia 16(Supl. 1): 75. 1979. TYPE: Panama. Panamá: N of Tocumen airport on road to Cerro Jefe, 2.5 mi. N of Lago Cerro Azul, ca. 700

m, *Croat 11529* (MO 2205477, holotype; F, K, NY, PMA, UC, US, VEN, isotypes; Live at MO).

Epiphytic; stem 1.5–2.5 cm diam., often to 40 cm long; cataphylls drying brown, remaining intact, soon deciduous; petioles 19–70 cm long, 6–10 mm diam., subterete, obscurely and narrowly sulcate (the sulcus less than 1 mm wide); blades moderately thick, ovate-triangular, prominently lobed at base, 30–75 cm long, 16–40 cm wide. Inflorescence erect-spreading; peduncles 15–40 cm long, 7–8 mm diam., terete, sometimes weakly ribbed on adaxial side, running the full length of the peduncle (continuous to the decurrent spathe); spathe greenish white to pale green, sometimes tinged purplish at base, oblong-elliptic or ovate-elliptic, moderately thin, 8–18 cm long, 2.5–5.8 cm wide; spadix cream, white to pale green, usually sessile (rarely with a stipe 2–10 mm long), 8.5–24 cm long, 12–15 mm diam. at base; berries bright red, usually white in lower half, narrowly ovoid; seeds 2. See Croat (1983: 362) for a more complete description.

Anthurium ravenii ranges from Honduras to the Pacific slope of Ecuador. It usually occurs in tropical wet and premontane wet forest from near sea level to 1,000 m, but it has also been found in tropical moist forest in Darién Province in Panama.

The species is a member of section *Calomystrium* and is unusual in having an orbicular, brushy, elevated stigma rather than a slit-like depressed stigma (in dried material, a darkened slit-like area becomes visible). Distinguishing features include major veins that dry reddish brown, a weak and brittle spathe, a scarcely tapered, whitish spadix, bluntly rounded at the apex, usually long-exserted stamens, and bright red berries.

CANAL ZONE: S of Colón, *Tyson et al. 4494* (SCZ); Río Pequení, *Fairchild et al. 104* (MICH); Summit Gardens, *Croat 12526, 16554, 17147* (MO).

CHIRIQUÍ: W slope of El Barú, *Tyson & Loftin 5966* (SCZ); vicinity of Gualaca, *Antonio 5168* (MO), *Croat 48673* (MO), *48718* (MO, PMA); road from Gualaca to Fortuna Dam site, *Croat 49900* (BH, FTG, MISSA, MO, SEL), *49969* (MO).

COCLÉ: Alto Calvario, *Croat 49193* (MO), *Folsom 2333* (MO); Cerro Caracoral, *Knapp 1119* (MO); Cerro Pilón, *Croat 14359* (MO), *Duke 12108* (MO), *Duke & Correa 14686* (US), *Dwyer et al. 4509, 4527* (MO), *Liesner 743* (MO); vicinity of El Copé, *Antonio 1175* (MO), *Croat 44725* (MO, PMA), *Folsom 1338* (MO), *Folsom & Lantz 1871* (MO), *Folsom & Collins 6483* (MO), *Hammel 2346A, 2404* (MO); 5 hour walk from sawmill at El Copé, *Antonio 3635* (MO); vicinity of El Valle de Antón, *Luteyn 1240, 1242* (DUKE), *Luteyn & Kennedy 1649, 1661* (DUKE), *Woodson & Schery 183* (MO); 9 km from El Valle Market beyond Furlong's Finca, *Kennedy et al. 3190* (MO); vicinity La Mesa, *Allen 2384* (US), *Croat 25319, 37336* (MO), *Gentry 5640* (MO), *Hammel 3833* (MO), *Kennedy et al. 3037* (MO), *Luteyn 3179* (DUKE), *Sullivan 514* (MO), *Wilbur et al. 15670* (MO); road from Llano Grande to Coclecito, *Croat 49232* (MO), *Hammel 1824* (MO); N of Penonomé, *Hammel 1678, 1683, 4022* (MO).

COLÓN: SW of Cerro Bruja, *Sytsma et al. 4268* (MO); Río Guanche, *Antonio 4781* (MO), *Croat 26232* (MO), *37003* (MO, PMA), *Kennedy & Foster 2203* (MO), *Knapp 1002* (MO, S), *Mori et al. 6478* (MO), *Mori & Witherspoon 7972* (MO); Río Iguanita near bridge along Portobelo Road, *Croat 49779* (MO); along Río Miguel de la Borda near Guásimo, *Croat 9913, 10004* (MO); Santa Rita Ridge Road, *Antonio 3868* (MO), *Croat 15336* (MO), *Witherspoon et al. 8332* (MO); near home of P. H. Zimmerman, *Folsom et al. 3329* (MO).

DARIÉN: S of El Real on Río Pirre, *Duke 5407* (MO); Loma Cuasí behind Manené, *Duke 13622* (US); Serranía de Pirre above Cana gold mine, *Croat 37745A* (MO).

PANAMÁ: Campo Tres, *Croat 27056* (MO); Cerro Campana, *Antonio 1733* (MO), *Bartlett & Lasser 16929* (MICH, MO), *Croat 14708, 14787, 35994* (MO), *17206, 17207* (DUKE, MO), *25206* (MO, PMA, US), *Hutchison & Dressler 2971* (UC), *Luteyn 1003, 3199* (DUKE), *Sheffer 212, 213, 214* (MO), *Witherspoon 8458, 8902* (MO); Cerro Jefe, *Sheffer 215* (MO), *Sullivan 208* (MO); N of Goofy Lake on road to Cerro Azul, *Croat 11529* (F, K, MO, NY, PMA, UC, US, VEN); La Eneida, *Luteyn & Foster 1113* (DUKE); El Llano-Cartí Road, *Antonio 3319, 4852* (MO), *Croat 49129* (MO), *Folsom & Skog 2466* (MO), *Folsom 3478* (MO), *Kennedy 2706* (MO), *Kennedy & Dressler 3354* (US), *Knapp 1374* (MO), *Liesner 1161* (MO), *Mori & Kallunki 2233* (MO), *Tyson & Nee 7353* (MO).

SAN BLAS: on trail from Puerto Obaldía, *Mori et al. 6841* (MO).

VERAGUAS: Cerro Tute, *Sytsma & Andersson 4625* (K); Río Segundo Braso, *Croat 25540* (MO); vicinity Santa Fe, *Antonio 3550, 3977, 4986, 4992* (MO), *Croat & Folsom 34230* (MO), *Croat 25956, 48894, 48924, 48933, 49064* (MO).

Anthurium redolens Croat, sp. nov. TYPE: Panama. Darién: NE slopes of Cerro Sapo, approach from Garachiné, 2,500 ft., *Hammel 7235* (MO 2815433, holotype; PMA, isotype; Live at MO).

Planta epiphytica; cataphyllum modice membranaceum persistens reticulo fibris tenuibus; petiolus anguste obtuseque sulcatus, (3–)5–19 cm longus; lamina subcoriacea, oblongo-elliptica, basi acuta, 26–44 cm longa, 4–9 cm lata, pagina inferiore nigro-glanduloso-punctata; inflorescentia erecta ad effusa; pedunculus teres, 30–48 cm longus; spatha viridis, membranacea, lanceolata, 3.5–8 cm longa, 0.7–2 cm lata; spadix lavandulus, 7–13.4 cm longus, stipite usque 3 cm longo, aromaticus sub anthesi; baccae rubrae, 6–7 mm longae.

Epiphyte; stems short, 1.5 cm diam., roots moderately thick, green, descending; cataphylls moderately thin, 5–7 cm long, acute and apiculate at apex (the apiculum 3–4 mm long, often curved), drying reddish brown, promptly weathering into fine, more or less loosely reticulate fibers. LEAVES erect or erect-spreading; petioles (3–)5–19 cm long, 4–8 mm diam., narrowly and obtusely sulcate, rounded abaxially; geniculum 1.5–2.5 cm long; blades subcoriaceous, oblong-elliptic, gradually acuminate at apex, acute at base, 26–44 cm long, 4–9 cm wide, usually broadest at the middle; upper surface matte, lower surface semiglossy, densely black glandular-punctate; midrib convexly raised above, sunken toward apex, prominently raised below; primary lateral veins 7–15 per side, departing the midrib at 30–45° angle, straight to collective vein, sunken above, raised below; interprimary veins scarcely visible; collective vein arising from the base, 5–7 mm from the margin, sunken above, raised below. INFLORESCENCE erect to spreading; peduncle 30–48 cm long, 4–6 mm diam., terete, 2–9 times longer than petiole; spathe green, thin, lanceolate, 3.5–8 cm long, 0.7–2 cm wide, broadest just above base, abruptly acuminate at apex, acute at base, inserted at 30° angle on peduncle, usually persisting; stipe 3–30 cm long, green sometimes faintly tinged red-violet; spadix lavender (B & K Purple 6/2.5), scarcely tapered toward apex, 7–13.4 cm long, 6.5–10 mm diam. near base, 4.5–6 mm diam. at apex; flowers rhombic to 4-lobed, 2.5–2.8 mm long, 2.4–2.7 mm wide, the sides usually jaggedly sigmoid, sometimes smoothly sigmoid (rarely straight), 5–8 flowers visible in the principal spiral, alternate spiral not obvious; lateral tepals 5–6-sided, 1.3–1.7 mm wide, the inner margin broadly rounded; pistils weakly emergent, pale green; stigmas linear-elliptic, 0.7 mm long, brush-like with droplets for several days before stamens emerge; stamens emerging promptly from the base, the laterals emerging well ahead of the alternates, pleasantly aromatic after stamens emerge; anthers lavender, held in a tight cluster around pistil, 0.3 mm long, 0.7 mm wide; thecae ovate, slightly divaricate; pollen white. INFRUCTESCENCE erect, to 2.5 cm diam. with berries exserted; berries red, narrowly ovoid to obovoid, acute at apex, 6–7 mm long, 3–4 mm diam., mesocarp somewhat mealy, translucent; seeds 2, creamy white, 2.5–2.7 mm long, 1.9–2 mm diam., 1.1–1.2 mm thick, enveloped in a gelatinous envelope with a short appendage at least on one end. Figs. 149 and 150.

Anthurium redolens is found in Coclé, Panamá and Darién Provinces in areas of premontane rain forest at 500 to 2,500 m.

The species is a member of section *Porphyrochitonium* and is distinguished by its oblong-elliptic, subcoriaceous, dark green, stiffly erect leaf blades, its obtusely sulcate petioles that are one-fourth to one-half as long as the blades, and especially by its prominently pedunculate, usually lavender to purplish spadix. It is similar to *Anthurium bakeri,* which dries with the collective vein similarly more prominent than the primary lateral veins, but that species has a more or less sessile, whitish spadix and primary lateral veins that are flat or only weakly sunken on live plants. It also has the lower blade surfaces much paler than the upper surfaces (particularly on dried plants). In *A. redolens* the primary lateral veins are noticeably sunken on live plants, and the lower surface is not markedly paler than the upper surface. *Anthurium redolens* emits an intense spicy aroma at anthesis similar to that of *A. hacumense,* a species that has a spadix of very similar color. The specific epithet *redolens* (meaning "diffusing an odor") refers to this scent. The spadix of *A. bakeri* is not fragrant.

Anthurium redolens is similar to *A. crassilaminum,* which also has a purplish spadix but the latter species differs in having a much thicker, usually broader blade with the primary lateral veins scarcely or not at all sunken.

COCLÉ: Continental Divide between El Copé & El Potroso, *Sytsma et al. 2424* (MO).

DARIÉN: Cerro Sapo, *Hammel 7235* (MO, PMA); NE of Jaqué, *Sytsma & D'Arcy 3299* (MO, PMA), *3346, 3434* (MO).

PANAMÁ: Serranía de Majé, S of village of Ipetí, *Knapp & Sytsma 2329* (K, MO, PMA, US).

Anthurium roseospadix Croat, sp. nov. TYPE: Panama. Panamá: Cerro Jefe, at summit, ca. 1,000 m, 15.4 mi. from Pan-American Hwy., 9°12′N, 79°22′W, *Croat 49091* (MO 2737325, holotype; CAS, DUKE, F, K, M, NY, PMA, US, VEN, isotypes; Live at MO).

Planta epiphytica aut interdum terrestris; caudex usque 70 cm longus; persistens intactum, ultimo deciduum; petiolus subteres, 12–37 cm longus, anguste complanatus adaxiale; lamina modice coriacea, ovata ad ovato-triangulata, basi leviter aut profunde cordata, 12–28 cm longa, 9–22 cm lata; inflorescentia erecta;

pedunculus teres, 7.5–18 cm longus; spatha subcoriacea, viridulo-alba interdum tincta rosea, ovato-elliptica ad oblongo-elliptica, 6–13 cm longa, 1.7–3 cm lata; spadix violaceo purpureus, 4–7 cm longus; baccae obovoido-ellipsoideae, basi albidae, apice brunneolae.

Epiphyte or less frequently terrestrial, rooted in deep debris, to 125 cm tall; stem moderately elongate, sometimes to 70 cm long, 1–2 cm diam.; internodes short near apex, sometimes more elongate in lower portion; leaf scars usually obscured by cataphylls, to 1 cm wide; roots moderately few, greenish, scattered along stem, ca. 4 mm diam.; cataphylls green, coriaceous, weakly cuspidate at apex, drying brown, persisting intact, ultimately deciduous. LEAVES spreading; petioles subterete, 12–37 cm long, 4–5 mm diam., narrowly flattened adaxially; geniculum 1.5–2 cm long, shaped like petiole or obscurely sulcate; blades moderately thick, ovate to ovate-triangular, abruptly acuminate at apex, shallowly or prominently lobed at base, 12–28 cm long, 9–22 cm wide, broadest at point of petiole attachment; anterior lobe 10.5–21 cm long, the margins straight to convex; posterior lobes 1.5–6.5 cm long; sinus arcuate to parabolic, rounded at apex; both surfaces semiglossy to glossy; midrib raised above, acutely raised below; basal veins 3–6 pairs, the first and sometimes the second free to the base, those remaining coalesced 0.5–1 cm, raised above and below; posterior rib absent or more or less straight, naked, weakly turned up along outer margin; primary lateral veins 4–8 per side, relatively inconspicuous, weakly sunken, straight or weakly arching near collective vein; lesser veins obscure, more conspicuous on drying; collective vein arising from second or third basal vein, loop-connecting the primary lateral veins, 2–8 mm from margin. INFLORESCENCE erect; peduncle terete, 7.5–18 cm long, 4–5 mm diam., ca. one-half as long as petioles; spathe subcoriaceous, greenish white sometimes tinged pinkish (B & K Yellow-green 9/10), ovate elliptic to oblong-elliptic, 6–13 cm long, 1.7–3 cm wide, broadest at the base, acuminate at apex, truncate to rounded at base; spadix violet purple (B & K Purple 3/10–4/5), scarcely tapered at apex, 4–7 cm long, 6–9 mm diam. at base, 3–6 mm diam. near apex; flowers rhombic to 4-lobed, 2–2.4 mm long, 2–3 mm wide, the sides jaggedly sigmoid, 6–7 flowers visible in the principal spiral, 5–8 flowers visible in the alternate spiral; tepals glossy, lateral tepals 1–1.2 mm wide, the inner margins concave, more or less angular; pistils flat to weakly mounded, white, glossy; stigmas linear, ca. 0.3 mm long, dry when stamens emerge; stamens emerging rapidly beginning at the base, anthers not exposed, pollen exuding from between pistil and tepals, held above and obscuring pistil; pollen white. INFRUCTESCENCE with obovoid-ellipsoid berries, ca. 8.5 mm long, white in lower portion, brownish near apex, mammilliform at apex; mesocarp gelatinous, transparent; seeds tan, ca. 5 mm long, 2 mm diam. Fig. 131.

Anthurium roseospadix is endemic to Panama. It was first collected by Dr. Edwin Tyson in January 1966, then again in February and July of the same year. Most collections are from the vicinity of Cerro Jefe in premontane rain forest, but the species has also been collected in the Canal Zone along the Caribbean at nearly sea level in what was probably premontane wet forest and possibly even tropical wet forest. Despite this drastic difference in elevation and life zone, the collection (*Mori & Kallunki 2738*) differs in no way from those on Cerro Jefe.

The species is a member of section *Calomystrium* and is distinguished by its coriaceous ovate to ovate-triangular cordate blade, its intact persistent cataphylls, its relatively short-pedunculate inflorescence, its thick greenish white, narrowly ovate-elliptic spathe, and especially by its stubby, slightly tapered violet purple spadix.

It may be confused with *Anthurium erythrostachyum,* another Panamanian member of section *Calomystrium* that has a similarly colored spadix, but the latter differs in that it has a greenish, cuspidate-acuminate spathe and thinner, typically more triangular-ovate blades. In addition, it more frequently has stems with elongate internodes that dry a characteristic pale reddish brown. In contrast, mature stems of *A. roseospadix* commonly have short internodes.

CANAL ZONE: between Fort San Lorenzo & Fort Sherman, *Mori & Kallunki 2738* (MO).

CHIRIQUÍ: Cerro Colorado, *Sullivan 291* (MO).

PANAMÁ: Cerro Jefe, *Almeda & Nakai 3473, 3474* (CAS), *Antonio 4723* (MO), *Correa & Dressler 1678* (MO), *1681* (PMA), *Croat 15226A, 35881* (MO), *49091* (CAS, DUKE, F, K, M, MO, NY, PMA, US, VEN), *Folsom & Harp 1363, 1385* (MO), *Folsom et al. 1855, 2016A, 2513, 5659* (MO), *Folsom & Page 5934* (MO), *Foster & Kennedy 1905* (DUKE), *Kennedy 1164* (DUKE, F), *Knapp 2256* (MO), *Liesner 582* (MO), *Luteyn 3208* (DUKE), *Mori et al. 3736* (MO, WIS), *Mori & Kallunki 6074* (MO), *Porter et al. 5068* (MO), *Sheffer 277, 278* (MO), *208, 280* (MO), *Tyson et al. 3198* (SCZ), *4388* (MO), *Tyson 3392* (SCZ), *Wither-*

spoon & Witherspoon 8485 (MO), *Witherspoon 8579, 8592* (MO).

VERAGUAS: headwaters of Río Caloveborita, past Escuela Agricola Alto Piedra, *Sytsma & Andersson 4773* (MO).

Anthurium rotundistigmatum Croat, Selbyana 5: 330. 1981. TYPE: Panama. Darién: Serranía de Pirre, along ascent above Cana gold mine between Río Cana and Río Escucha Ruido, 600–1,000 m, premontane rain forest (Holdridge Life Zone Map), *Croat 37745* (MO 2465320, holotype; F, K, NY, PMA, US, VEN, isotypes; Live at MO).

Epiphyte; stems 15–30 cm long, 1.5–2.5 cm diam.; leaf scars 1.4–2 cm wide, roots few, 2–3 mm diam.; cataphylls coriaceous, (5–)9.5–10 cm long, acute and apiculate at apex (the apiculum ca. 2 mm long), green or suffused with violet purple, turning brown on drying (B & K Red 9/10), deciduous more or less intact. LEAVES with petioles erect or spreading, (22–)28–40 cm long, 4–6 mm diam., sometimes tinged purplish near base, shallowly and bluntly sulcate, rounded abaxially; geniculum 2–4 cm long, same color and shape as petiole; blades ovate-triangular, acuminate and downturned at apex, deeply lobed at base, (23–)26–56 cm long, 17–30 cm wide, broadest at point of petiole attachment, the anterior lobe 19–45 cm long, the posterior lobes 7–18 cm long, the sinus parabolic, sometimes spathulate, rounded or obtuse at apex; upper surface matte to semiglossy, lower surface matte; midrib prominently and convexly raised below; basal veins 5–7 pairs, up to 5 of them coalesced 2.5–3 cm, paler than surface and sunken or raised in valleys above, the posterior rib naked ca. half way, the outer margin rolled inward except near the point of petiole attachment; primary lateral veins 4–8 per side, departing midrib at 40–45° angle, paler than surface, sunken above, raised and paler than surface below, arcuate ascending; interprimary veins flat or sunken and paler above, raised and darker below; collective vein arising from near apex, 2–6 mm from margin, sunken above, raised below. INFLORESCENCE spreading; peduncle 8–13.5 cm long, 3–7 mm diam., flexible to more or less stiff, shorter than petiole; spathe subcoriaceous, pale green heavily tinged with reddish purple at anthesis, usually drying reddish brown, oblong-oblanceolate, 8–12.5 cm long, 1–3.8 cm wide, broadest ca. 2 mm above the point of attachment, acuminate at apex, rounded at base, inserted at ca. 45° angle on peduncle, spreading and often twisted, the margins upturned, forming a pocket at the base; spadix purplish (B & K Purple 2/2.5) at anthesis, 10–17 cm long, 7–11 mm diam. at base, 4–5 mm diam. at apex; flowers 4-lobed, 3–3.5 mm long, 2–2.5 mm wide, the sides jaggedly sigmoid, 9–12 flowers visible in the principal spiral, 7–8 flowers visible in the alternate spiral; tepals dark purple with pale punctations, minutely papillate, semiglossy, separating as stamens emerge to show deep, pale yellow cracks, the lateral tepals 1.6–1.8 mm wide, the outer margin irregularly 3-sided; pistil slightly emergent at anthesis, paler than tepals (translucent white suffused with purple), at first covered by tepals, exposed ca. 1 week before first stamens emerge, becoming prominently exserted; stigma oblong-elliptic, white, ca. 0.5 mm long with glistening papillae, filled with droplets 4–6 days before stamens emerge, dry when stamens open; stamens usually emerging from the base or sometimes scattered throughout, developing a full complement promptly except for the flowers in the advancing spirals, the stamens positioned at random around pistil; filaments retracting to hold anthers against pistil, transparent, ca. 0.7 mm long, 0.6 mm wide; anthers yellow, held curved over pistil before opening, ca. 0.9 mm long, 0.7–0.8 mm wide; thecae ellipsoid, not divaricate; pollen yellow fading white (B & K Yellow 9/7.5). INFRUCTESCENCE pendent, to 25 cm long, 4 cm diam. with berries exserted; berries obovoid, rounded at apex, ca. 6 mm long, 4.5 mm diam., red at apex, the exposed area around the style round and scurfy, ca. 2 mm diam.; pericarp thin, with moderately few punctiform raphide cells near the apex; seeds 2, broadly ellipsoid, markedly flattened, greenish, 2.5–3 mm long, 2.2–2.5 mm wide. Figs. 143 and 144.

The species is known for certain from tropical wet and premontane wet forest at elevations of 500 to 1,000 m in Darién Province. Sterile collections from Cerro Jefe (*Croat 35924* MO) and Cerro Tute (*Croat & Folsom 34233* MO) are probably also this species. Another sterile collection (*Croat 34440* MO) from tropical moist forest at less than 150 m also matches this species but is well outside the expected ecological range of the species.

The species is a member of section *Belolonchium* and is best characterized by its thin, ovate-triangular leaves, its purpish spadix, and especially the markedly protruding, round (hence the

name *rotundistigmatum*) stigmas that emerge from the tepals well before the stamens emerge. Though sterile collections of *Anthurium rotundistigmatum* can be confused with *A. ochranthum,* the latter species is consistently terrestrial and has a bright yellow spadix at maturity with pollen usually oozing from submerged anthers in slender paste-like ribbons.

DARIÉN: La Boca de Pirre, *Bristan 1291* (US); headwaters of Río Tuquesa, *Croat 27130, 27142, 27192A* (MO); Serranía de Pirre above Cana gold mine, *Croat 37745* (F, K, MO, NY, PMA, US, VEN); Cerro Pirre, *Folsom 4399, 4400* (MO).

PANAMÁ: vicinity Cerro Jefe, *Croat 35924* (MO); Río Majé, *Croat 34440* (F, MO, PMA, US).

VERAGUAS: above Santa Fe, Cerro Tute, *Croat & Folsom 34233* (MO), *Croat 34238* (MO).

Anthurium rubrifructum Croat, sp. nov. TYPE: Panama. Darién: Cerro Pirre, ridge top near Rancho Plastico, 1,200 m, *Folsom 4287* (MO 2623494, holotype).

Planta scandens epiphytica; cataphyllum findens in fibris tenuibus; petiolus complanatus adaxiale marginibus acutibus, 23–24 cm longus; lamina subcoriacea, triangulata, posticis lobis hastatis, basi profunde cordata, 31–36.5 cm longa, 19–20 cm lata; inflorescentia foliis breviore; pedunculus costatus, ca. 11.5 cm longus; spatha membranacea, pallide viridis, anguste lanceolata, 10.5 cm longa, 1.1 cm lata; spadix 4–4.5 cm longus (forte laesus); baccae rubrae.

Scandent epiphyte; stem ca. 1 cm diam.; internodes 1–1.2 cm long; cataphylls 11 cm long, weathering to fine fibers, ultimately deciduous. LEAVES with petioles 23–24 cm long, flattened adaxially with sharp margins; geniculum ca. 1 cm long; blades triangular, conspicuously hastate lobed, drying subcoriaceous, long acuminate at apex, deeply lobed at base, 31–36.5 cm long, 19–20 cm wide, broadest near base; anterior lobe 23–26 cm long, the margins convex near apex, weakly constricted toward the base; posterior lobes 11.2–12.5 cm long (from apex of sinus to outermost point), 6–6.5 cm wide, directed outward from petiole; both surfaces matte (dry), the lower surface much paler; midrib scarcely raised above, raised below; basal veins 5–7 pairs, the first free to the base, those remaining coalesced 1.3–2.5 cm, prominulous above, raised below; primary lateral veins 8–10 per side, straight to collective vein, prominulous above, raised below, lesser veins conspicuous on drying; collective vein arising from one of the lowermost basal veins, loop-connecting the preceding basal veins and the primary lateral veins, 3–4 mm from margin, flat to scarcely raised above, raised below. INFLORESCENCE shorter than leaves; peduncle ribbed, ca. 11.5 cm long; spathe moderately thin, pale green, narrowly lanceolate, 10.5 cm long, 1.1 cm wide, acuminate at apex, spadix not seen at anthesis. INFRUCTESCENCE with spadix 4–4.5 cm long (possibly damaged), 7 mm diam. near base, 4 mm diam. near apex; berries red. Fig. 125.

Anthurium rubrifructum is known only from the type locality in Panama in Darién Province on Cerro Pirre in lower montane wet forest at 1,200 m. It is also expected to occur in Colombia.

The species is placed with reservation into section *Xialophyllium.* It is placed here largely because of its viney habit. Perhaps it will prove to be aligned with section *Belolonchium* or a totally new sectional grouping.

It is recognized by its scandent habit, its D-shaped petioles, and by its more or less panduriform leaf blades with the posterior lobes longer than broad and projecting outward at about 130° angle from the midrib. Also characteristic are its ribbed peduncles, its green oblong-lanceolate spathe, and its red berries.

The species is not easily confused with any other in Panama. *Anthurium panduriforme* may have a similar leaf shape but its blades dry a light golden green color, are markedly glossy, and have many more primary lateral veins. In contrast, those of *A. rubrifructum* dry dark olive brown and are not markedly glossy.

DARIÉN: Cerro Pirre, *Folsom 4287* (MO), *Hartman et al. 4481* (MO).

Anthurium rupicola Croat, sp. nov. TYPE: Panama. Veraguas: Valley of Río Dos Bocas, 11 km NW of Escuela Agricola Alto Piedra (above Santa Fe) on road to Calovébora, 450 m, *Croat 27526* (MO 2253471, holotype; B, BR, C, COL, CR, DUKE, F, G, GH, K, M, MEXU, MICH, NY, P, PMA, R, RSA, S, SEL, U, UC, US, VEN, W, isotypes).

Planta epipetrica; cataphyllum membranaceum persistens fibris tenuibus; petiolus teres ad ellipticus aut complanatus, costa median adaxiale, 8–19 cm longus; lamina subcoriacea, anguste oblongo-elliptica, raro lanceolato-oblonga, basi anguste acuta, 14–22 cm longa, 2.2–4 cm lata, pagina superiore sparsim glanduloso-punctata; inflorescentia erecta et effusa; pedunculus teres, 12–28 cm longus; spatha viridis, modice membranacea, lanceolata, 2.5–4.7 cm longa, 5–10 mm lata; spadix stipite usque 5 mm longo, albus, 2.5–4.5 cm longus; baccae subglobosae, purpureae, 4–5 mm diam.

Epipetric; stems less than 10 cm long, 1–1.5 cm diam.; internodes short; leaf scars hidden by cataphylls; roots numerous, descending, ca. 3 mm diam.; cataphylls 3–4.5 cm long, thin, green, acuminate at apex, promptly weathering to fine, tan, persistent fibers. LEAVES erect-spreading; petioles terete to ellipsoid in cross-section, or flattened adaxially with a medial rib, 8–19 cm long, usually one-half to three-fourths as long as the blade; geniculum ca. 1 cm long; blades subcoriaceous, narrowly oblong-elliptic to rarely lanceolate-oblong, gradually acuminate at apex (the acumen apiculate), narrowly acute at base, 14–22 cm long, 2.2–4 cm wide, broadest usually at the middle; both surfaces semiglossy, drying more or less matte, sparsely and inconspicuously glandular-punctate on the upper surface, conspicuously glandular-punctate on the lower surface; midrib prominently raised on both surfaces; primary lateral veins 8–10 per side, scarcely or not at all more conspicuous than the interprimary veins, departing midrib at 55–70° angle, straight or weakly curved to the collective vein; interprimary veins numerous, drying prominulous on both surfaces; collective vein sunken above, raised below, generally more prominent than the lateral veins, inconspicuously loop-connecting the primary lateral veins. INFLORESCENCE erect-spreading, usually several per plant at flowering time; peduncle terete, 12–28 cm long, 2–3 mm diam.; spathe green, moderately thin, lanceolate, 2.5–4.7 cm long, 5–10 mm wide, broadest usually just above the base, abruptly to gradually acuminate at apex, acute at base, inserted at 45° angle on peduncle; stipe usually to 5 mm long; spadix white at anthesis, moderately tapered to apex, 2.5–4.5 cm long, 3–5 mm diam. near the base, 2–3 mm diam. near the apex; flowers subquadrangular, 2–2.6 mm long, ca. 2.5 mm wide, 3–4 flowers visible in the principal spiral, 4–6 visible in alternate spiral; tepals semiglossy, the lateral tepals 1–1.4 mm wide, the inner margin thin, obtusely angular, stamens retracted after anthesis; anthers 0.6 mm long, 0.8 mm wide, thecae ovoid, divaricate; pistil early emergent and beginning to color long before maturity. INFRUCTESCENCE erect; berries (dried) subglobose, beaked at apex, red to violet purple, 4–5 mm diam.; seeds 2, tan to brown, 2.4–2.8 mm long, 1.8–2.1 mm diam., 1–1.3 mm thick, encased in a thin, gelatinous envelope, scarcely elongate at either end. Fig. 135.

Anthurium rupicola is endemic to central Panama in the Provinces of Coclé and Veraguas at 150 to 800 m in tropical wet and premontane rain forest life zones. The species has been consistently collected on rocks or along the edge of fast moving streams.

It is a member of section *Porphyrochitonium* and is distinguished by its narrowly lanceolate, long-acuminate, densely and minutely glandular-punctate leaves, its stiffly erect-spreading, lanceolate, green spathe, its white, cylindroid spadix, and by its violet purple berries. The venation of the blades is especially characteristic, with the interprimary veins of dried specimens equally as prominent as the primary lateral veins but less prominent than the collective vein.

Anthurium rupicola has been collected in association with *A. amnicola,* another rupicolous species that differs in having a pale violet purple spathe, a dark violet purple spadix, and leaf blades that are glandular-punctate only on the upper surface.

Anthurium rupicola has been confused with *A. lancifolium* but the latter differs in being terrestrial or epiphytic (not growing on rocks in and along streams), and in having generally much larger leaves, usually broadest below the middle with the primary lateral veins much more prominent than the interprimary veins. In addition, *A. lancifolium* generally has a much larger spadix with about five flowers visible in each of the principal spirals.

Two collections from the Chocó Department of Colombia (*Idrobo 1901,* Condoto and *Juncosa 1175,* "La Equis" mine north of Quibdó-Bolivar road at Km 182–183) are similar to this species, but one is described as having white berries, and the dried glands on the lower blade surface of both collections are very pale, visible only upon magnification. In this respect the Idrobo collection is similar to *A. antioquiense* Engl., which also has inconspicuously punctate leaf blades. *Anthurium antioquiense* differs from the Idrobo collection in having a white spathe, a lavender spadix, and blades that have few primary lateral veins drying much more prominent than the interprimary veins. The Idrobo collection has a green spathe and leaf blades with the primary and interprimary veins scarcely distinguishable from one another.

COCLÉ: 5 hour walk from sawmill at El Copé, *Antonio 3614* (MO); along trail from Caño Sucio to Cerro Tife, *Antonio 3677* (MO); forest around Limón, *Folsom 5806* (F, MO); along river leading up mountain to Alto Cal-

vario, *Folsom 5899* (F, MO); trail from Río San Juan to Río Tife Falls, *Hammel 3305, 3370* (MO).

VERAGUAS: valley of Río Dos Bocas, on road to Calovébora, *Croat 27526* (B, BR, C, COL, CR, DUKE, F, G, GH, K, M, MEXU, MICH, MO, NY, P, PMA, R, RSA, S, SEL, U, UC, US, VEN, W), *Mori & Kallunki 3178* (MO, PMA, SEL, US); NW of Santa Fe, *Mori & Kallunki 6137* (MO, PMA, US).

Anthurium sagawae Croat, sp. nov. TYPE: Panama. Panamá: Cerro Jefe, ca. 800 m (collected originally by Kamemoto and Sagawa and cultivated at the University of Hawaii and at the Missouri Botancial Garden), *Kamemoto & Sagawa 251* (MO 2815436–37, holotype; K, PMA, isotypes; Live at MO).

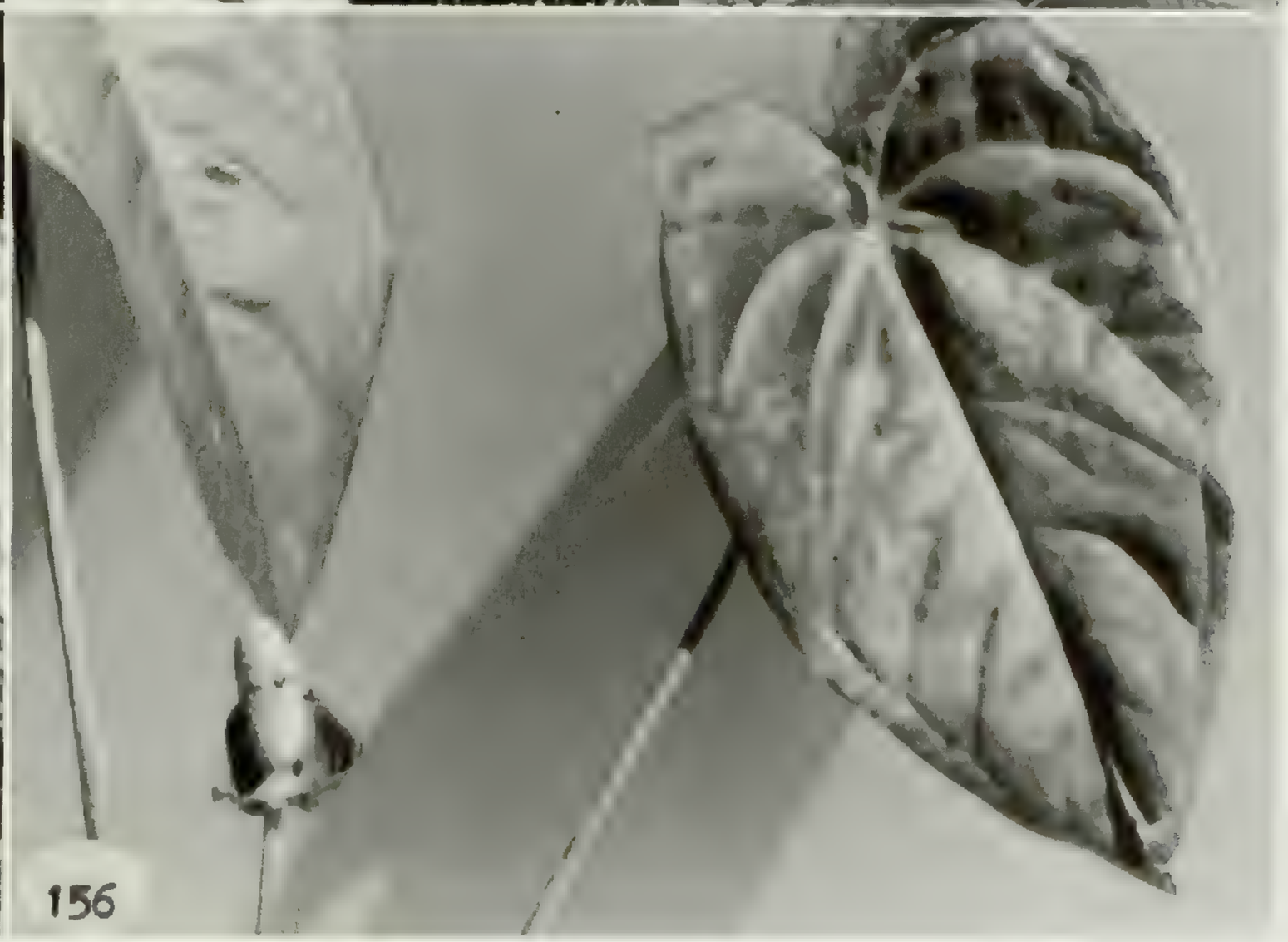
Planta epiphytica; cataphyllum persistens fibris tenuibus; petiolus acute triangulatus, camplanatus ad anguste profundeque sulcatus adaxiale, 21–28 cm longus; lamina subcoriacea, oblanceolato-elliptica ad elliptica, basi acuta ad leviter attenuata, 29–43 cm longa, 11.5–16 cm lata; pagina inferiore rubiginosa, glanduloso-punctata; inflorescentia effusa ad pendula; pedunculus 4–5 costatus, 40–47 cm longus; spatha pallide viridis, linearo-lanceolata, 5–15 cm longa, 5–15 mm lata; spadix flavovirens, 10–25 cm longus; baccae atropurpureae, obovoideae, 6.8–7 mm longae.

Epiphyte; stems sometimes branching, to 30 cm long, ca. 2 cm diam.; leaf scars 1.6 cm wide; roots pale green, 3–5 mm diam., directed upward from upper part of stem; cataphylls 4–5 cm long, acute and apiculate at apex, drying brown, weathering into fine, persistent fibers. LEAVES erect-spreading; petioles sharply 3-sided, flattened to narrowly and deeply sulcate adaxially, sharply 1-ribbed abaxially, the sides convex, 21–28 cm long, 6–7 mm wide; geniculum 1.5–2 cm long, shaped like petiole; blades subcoriaceous, oblanceolate-elliptic to elliptic, abruptly acuminate at apex (the acumen flat), acute to weakly attenuate at base, 29–43 cm long, 11.5–16 cm wide, broadest at about middle; upper surface semiglossy, lower surface much paler, sparsely dark reddish brown, glandular-punctate; midrib convexly raised above, narrowing toward apex, sunken at apex, acutely raised below; primary lateral veins 8–12 per side, departing midrib at ca. 50° angle, more or less straight to collective vein, sunken above, raised below; lesser veins scarcely visible; collective vein arising from the base, 6–15 mm from the margin, prominently loop-connecting the primary lateral veins, sunken above, raised below. INFLORESCENCE spreading to pendent, equalling or longer than leaves; peduncle 40–47 cm long, 3–5 mm diam., 4–5-ribbed, appearing twisted, 1.5 times longer than petioles; spathe pale green (B & K Yellow-green 6/7.5), linear-lanceolate, 5–15 cm long, 5–15 mm wide, broadest just above base, acuminate at apex, rounded at base, twisted, soon withering; spadix yellow-green (B & K Yellow-green 6/7.5), 10–25 cm long, 4–6 mm diam. near base, 3–4 mm diam. near apex; flowers rhombic, 3.5–4 mm in both directions, 3–4 flowers visible in the principal spiral, 4–5 visible in the alternate spiral, tepals semiglossy; lateral tepals 2–2.1 mm wide, the inner margins broadly rounded; pistils weakly emergent, green; stigmas whitish with droplet for ca. 10 days before stamens emerge; stamens emerging in a prompt, regular sequence beginning at base, the laterals followed rapidly by alternates, the full complement persisting briefly then retracting; anthers white, ca. 0.6 mm long, 0.8 mm wide; pollen white. INFRUCTESCENCE pendent, the spadix to 32 cm long; berries violet purple (B & K Purple 3/7.5), obovoid, weakly emarginate at apex, 6.8–7 mm long, 5–6.5 mm diam.; mesocarp juicy with few, white raphide cells; seeds 2 or 3, creamy white, weakly flattened, 2.5–3 mm long, 1.5–2 mm wide, 1.4–1.5 mm thick, narrowly rounded at base, oblique at apex with a short sticky appendage. Figs. 153 and 154.

Anthurium sagawae is apparently endemic to Panama and was collected in premontane rain forest at 800 m. The type collection was made by Kamemoto and Sagawa on Cerro Jefe. At that time Cerro Jefe was relatively undisturbed unlike the present where little natural vegetation remains. Live collections exist at the University of Hawaii and the Missouri Botanical Garden. It has not been seen since the original collection.

The species is in section *Porphyrochitonium* and is distinguished by its long petiolate, coriaceous, elliptic, punctate leaves with a sharply angulate midrib below, its sharply three-sided petiole with a narrow, deep sulcus, and by its long, slender spadix and dark violet purple berries, which are more or less emarginate at the apex with the style sunken in a pit-like depression.

The species appears to be at least distantly related to *Anthurium crassiradix* with which it shares relatively elongate spadices and similar berries that are usually truncate at the apex with a circular depression. The latter differs in having generally much smaller blades, usually broadest



FIGURES 153–156. 153, 154. *Anthurium sagawae* Croat, *Kamemoto 251.*—155. *Anthurium sanctifidense* Croat, *Croat 33956.*—156. *Anthurium globosum* Croat, *Sytsma 4966.*

near the base and often rounded or even subcordate at the base.

PANAMÁ: Cerro Jefe, *Kamemoto & Sagawa 251* (K, MO, PMA), *Sheffer 149, 248* (MO).

Anthurium salviniae Hemsl., Diagn. Pl. Nov. Mexic. 36. 1878. TYPE: Guatemala. Volcán Fuego, *Salvin s.n.* (K).

Anthurium giganteum Matuda, Madroño 10: 169. 1950 non Engl., 1898. *Anthurium enormispadix* Matuda, Revista Soc. Mex. Hist. Nat. 11: 94. 1950. TYPE: Mexico. Chiapas: Escuintla, Salto de Agua, *Matuda 18043* (MEXU, holotype; UC, isotype).

Robust rosulate epiphyte, rarely on rocks; stems short with mass of thick roots; cataphylls cucullate, drying brown, remaining intact, ultimately becoming fibrous at base; petioles flattened or sulcate adaxially, rounded abaxially, 5–23 cm long, 1–2 cm diam.; blades obovate to oblanceolate, moderately thick, attenuate, sometimes cuneate (rarely rounded or subcordate) at base, (32–)40–180 cm long, (9–)13–50 cm wide. Inflorescence usually pendent; peduncle 16–80 cm long; spathe lanceolate-linear, moderately thin, green sometimes tinged purple or violet purple, 4–45(–50) cm long, 1–5 cm wide; spadix dull green soon tinged throughout with lavender, 6–34(–47) cm long, 0.6–1.5 cm diam. at base; berries red, oblong-elliptic, 1–1.5 cm long; seeds 2. See Croat (1983: 369) for a more complete description.

The species occurs in western Mexico (Chiapas) along the Pacific slope of Guatemala and along both the Atlantic and Pacific slopes from Nicaragua to Panama. It also occurs in Colombia and has been collected in Chigorodo and Dabeiba in Antioquia. *Anthurium salviniae* occurs from near sea level to 1,400 m in wetter parts of tropical moist, premontane wet, tropical wet, and also rarely in premontane rain forest.

Anthurium salviniae is a member of section *Pachyneurium* and can be distinguished by its long tapered, pale lavender spadix, its long tapered spreading spathe, and by its fist-shaped, cucullate cataphylls. In addition, *A. salviniae* usually dries dark and thin.

CANAL ZONE: Balboa, *Standley 28564* (MO); Barro Colorado Island, *Bailey & Bailey 72* (BH), *Croat 4231, 4554, 6511, 7292, 7920, 8495, 8512, 9534, 10195, 11325* (MO), *Ebinger 181* (MO), *Shattuck 638* (MO); hills W of Canal near Gatún, *Standley 27210* (US); around Culebra, *Gaillard 2698* (US); around Frijoles, *Pittier 2679* (US); Gatún Lake, *Standley 31343* (US); between Gorgona and Gatún, *Pittier 2278* (US); Las Cascadas, *Dodge & Hunter 8651, 8659a, 8662* (MO); Madden Dam along Azote Caballo Road, *Dodge 16579* (MO); Obispo, *Standley 31719* (US); Orchid Garden, Ancon Hill, *Bartlett & Lasser 16609* (MICH, MO); Quebrada Ancha, *Steyermark & Allen s.n.* (MO); headwaters of Río Casaya, E of Gamboa, *Nee 9024* (MO); along Río Indio de Gatún, *Pittier 2801* (US); Salamanca Hydrographic Station, *Dodge et al. s.n.* (MO); Summit Garden, *Croat 10281* (MO).

CHIRIQUÍ: Cerro Colorado, *Antonio 1527* (MO), *Croat 33498* (MO); San Bartolo Limite, W of Puerto Armuelles, *Busey 593* (MO); SW of Portobelo, *Liesner 1075* (MO, US).

DARIÉN: S slope of Cerro Tacarcuna, *Gentry & Mori 13892* (MO); Line CC, *Duke 5235* (MO); NE of Jaqué, *Sytsma & D'Arcy 3433* (MO); Serranía de Pirre, *Croat 37751* (MO).

PANAMÁ: S of Alcalde Díaz, *Nee 8566* (MO); around Alajuela, *Pittier 2344* (US); SW of Cerro Brewster, *Lewis et al. 3475* (MO); Río Majé, *Croat 34441* (MO), *34600* (F, MO, US); mountains above Tortí Arriba, *Folsom et al. 6584* (MO), Serranía de Majé, *Folsom & Collins 1701* (MO).

Anthurium sanctifidense Croat, Selbyana 5: 334. 1981. TYPE: Panama. Veraguas: 0.2 mi. beyond fork in road at Escuela Agricola Alto Piedra, above Santa Fe, ca. 750 m, *Croat & Folsom 33957* (MO 2381537, holotype; C, CAS, CR, F, K, NY, PMA, SEL, US, VEN, isotypes; Live at MO).

Terrestrial, rarely epiphytic; stem 1.5–2 cm diam., to 30 cm long or more; leaf scars often hidden by persisting cataphylls; roots stout, green to grayish; cataphylls moderately thick, 10–20 cm long, cuspidate-acuminate at apex, drying reddish brown, persisting intact. LEAVES usually erect; petioles 33–50 cm long, 4–11 mm diam., subterete, shallowly and bluntly sulcate; geniculum 2.5–3 cm long, shaped like petiole, sometimes greatly thickened where it meets the blade; blades broadly ovate, lobed at base, abruptly acuminate at apex (the acumen slightly twisted, downturned), 21–57 cm long, 16–46 cm wide, broadest at point of petiole attachment, anterior lobe 16–35 cm long, the margins broadly rounded; basal lobes 5–14 cm long, directed basally or somewhat outward, the sinus parabolic to broadly triangular, obtuse to rounded at apex; upper surface matte to semiglossy, drying dark brown with sparse, pale, linear raphide cells, lower surface moderately paler with many pale, weakly raised, round glands (not dark punctations); midrib obtusely raised above and below, diminished and sunken at apex above, basal veins 5 or 6 pairs, 2 or 3 of them coalesced 1.5–3 cm, raised at base, sunken near margin above, raised

below, the posterior rib straight to slightly curved, naked, the outer margin rolled upward; primary lateral veins 5–7 per side, departing midrib at ca. 45° angle, more or less straight to collective vein, raised or sunken above, raised below; lesser veins less conspicuous; submarginal collective vein arising from the uppermost basal vein or one of the primary lateral veins, 5–7 mm from the margin, weakly sunken above, weakly raised below. INFLORESCENCE stiffly erect; peduncle 7–36 cm long, 5–8 mm diam., subterete, one-sixth to one-third as long as petioles; spathe pale green to greenish white, medium thick, ovate to lanceolate or oblong-elliptic, 5.5–15 cm long, 2.8–3.4 cm wide, broadest just above peduncle, cuspidate-acuminate at apex (the acumen 1.5–3 cm long), obtuse to weakly subcordate at base, reflexed-spreading, decurrent ca. 6 mm, the margins turned down near the base; stipe 2–7 mm long in back, green; spadix greenish white (B & K Yellow-green 9/7.5), 6.7–15 cm long, 9–11 mm diam. near base, 5–9 mm diam. near apex; flowers subrhombic to 4-lobed, 3–3.3 mm long, 3.3–3.6 mm wide, the sides jaggedly sigmoid to almost straight, the sides parallel to the spiral, straighter than those perpendicular to the spiral, 7–17 flowers visible in the principal spiral, 5–11 flowers visible in the alternate spiral; tepals glossy, smooth, the lateral tepals 1.4–1.8 mm wide, the inner margin very broadly rounded to almost straight, turned up against pistil; pistils flat to moderately exserted, pale green to white, becoming purplish, exserted 0.3–0.7 mm at anthesis; stigma tufted, raised, colorless, extending ca. 0.3 mm above the pistil; stamens emerging, scattered from the middle and soon progressing toward both ends, held over the pistil; anthers creamy white, 0.5–0.6 mm long, 0.8–0.9 mm wide, obscuring pistil when completed; thecae narrowly ovoid, slightly divaricate; pollen white. INFRUCTESCENCE with spathe persistent, the spadix purplish; berries obovoid, ca. 8 mm long, 5.5 mm wide, rounded at apex, violet purple, sometimes whitish toward the base; pericarp thin sometimes with moderately conspicuous linear raphide cells; seeds 2, pale green (?), encased in a mucilaginous, transparent sack, to ca. 6.5 mm long, moderately flattened, oblong-ellipsoid, emarginate at apex, 5–6 mm long, 2.7–4 mm wide. Figs. 155 and 160.

Anthurium sanctifidense is known only from Panama, although it is expected to occur in the Chocó of Colombia. It is known from areas of tropical wet and premontane rain forest on both sides of the isthmus and on both sides of the Continental Divide.

The species is a member of section *Calomystrium* and is distinguished from other Panamanian species in this section by its frequently terrestrial habit, its pale, matte lower leaf surface, and by its purplish berries. It is most easily confused with *Anthurium hoffmannii,* but that species is probably more frequently epiphytic, has leaf blades semiglossy on the lower surface, and has red berries.

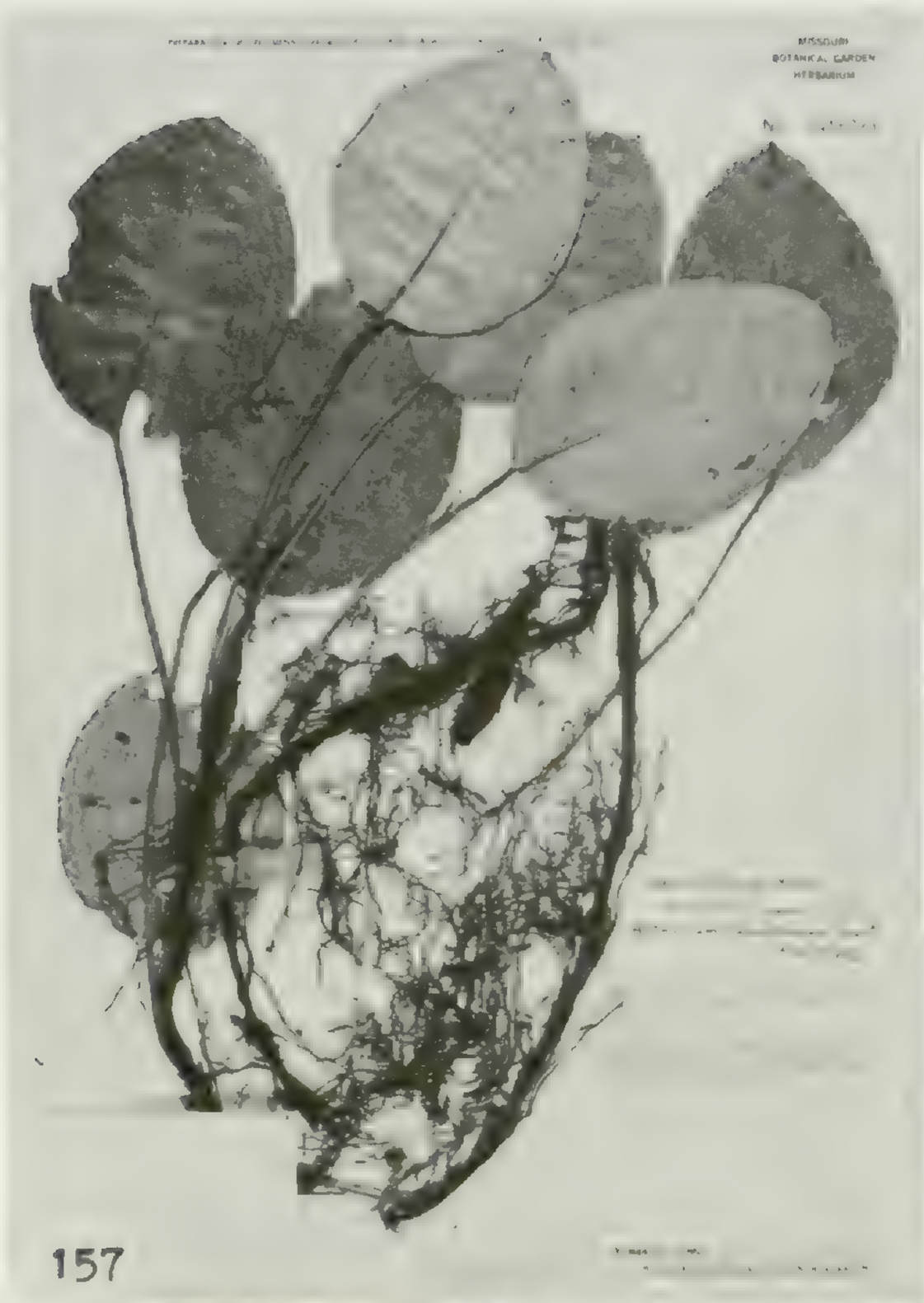
The species name refers to Santa Fe in Coclé Province where it was first collected.

CHIRIQUÍ: Cerro Colorado, *Croat 37100* (MO).
COCLÉ: Alto Calvario, *Croat 49191* (MO), *Folsom & Jaslon 2692* (MO); El Copé, *Croat 44567, 44575* (MO), *Folsom 1339* (MO), *Folsom & Lantz 1873* (MO), *Hammel 1051, 2346* (MO), *Sytsma et al. 2610* (MO); above El Potroso, *Sytsma 1826* (MO); New Works at Rivera sawmill, *Folsom 3182* (MO).
COLÓN: S approach to Cerro Bruja from Escandaloso, *Hammel 3152* (MO).
DARIÉN: vicinity Tyler Kittredge gold mining camp, *Croat 27285* (MO).
PANAMÁ: Altos de Pacora, *Lewis et al. 2327* (MO, US), *Liesner 580* (MO); Cerro Jefe, *D'Arcy & D'Arcy 6231* (MO), *Luteyn 1326* (DUKE); El Llano-Cartí Road, *Antonio 1280* (MO), *Busey 889* (MO), *Croat 26067, 34803* (MO), *49105, 49131A* (FTG, MO), *Folsom 2585, 3489, 3491* (MO), *Kennedy et al. 3136* (MO), *Liesner 1235* (MO), *Nee 7943* (MO), *Sytsma 1733* (MO).
SAN BLAS: SW of Puerto Obaldía, *Croat 16819* (MO).
VERAGUAS: beyond Escuela Agricola Alto Piedra on road to Río Calovébora, *Croat & Folsom 33957* (C, CAS, CR, F, K, MO, NY, PMA, SEL, US, VEN); vicinity Santa Fe, *Croat 23015A, 27598, 27698A, 48894A, 48998, 48901, 48922, 49029* (MO), *Croat & Folsom 34129* (MO), *Folsom & Collins 1607, 1617* (MO), *Folsom 2983* (MO), *Gentry 2971* (MO), *Hammel 4647* (MO), *Liesner 829* (MO), *Mori et al. 3803a* (MO), *Mori & Kallunki 6192* (MO), *Nee 9718* (MO).

Anthurium sapense Croat, sp. nov. TYPE: Panama. Darién: Serranía del Sapo, Cerro Sapo, to 1,085 m, ca. 7°41′N, 78°09′W, *Hammel 1168* (MO 2634183, holotype; PMA, isotype).

Planta epiphytica; cataphyllum modice coriaceum, persistens intactum; petiolus obtuse sulcatus, 31–55 cm longus; lamina subcoriacea, ovato-triangulata, basi profunde cordata, 27–31 cm longa, 20–22 cm lata; inflorescentia foliis longiora; pedunculus teres, 53–74 cm longus; spatha alba, late ovata ad obovata, 10–13 cm longa, 5.5–7.2 cm lata; spadix sessilis, roseus, 7–9 cm longus; baccae albae.

Epiphyte; stems to 1.5 cm diam.; internodes short near apex but quite elongate in lower por-



FIGURES 157–160. 157. *Anthurium subrotundum* Croat, *Croat 37951.*—158. *Anthurium globosum* Croat, *Sytsma 4966.*—159. *Anthurium globosum* Croat, *Folsom 7215.*—160. *Anthurium sanctifidense* Croat, *Croat 33957.*

tion of stem; leaf scars inconspicuous; cataphylls 15–16 cm long, moderately thick, abruptly acuminate at apex, turning reddish brown and persisting intact. LEAVES with petioles 31–55 cm long, obtusely sulcate; geniculum ca. 1.5 cm long; blades subcoriaceous (dry), ovate-triangular, acuminate at apex, deeply lobed at base, 27–31 cm long, 20–22 cm wide, broadest at the base or at point of petiole attachment; anterior lobe 17–21 cm long, the margins straight to weakly concave, the posterior lobes narrow, broadly curved downward, 12–13 cm long (from apex of sinus to tip of lobe); sinus mostly hippocrepiform when flattened, rounded at apex; both surfaces semiglossy; midrib and basal veins drying raised above, sharply raised below, the basal veins 6 or 7 pairs, the first pair (and sometimes the second pair) free to the base, the third pair coalesced to the higher order veins 2–3 cm, the posterior ribs curved, naked for 4–4.5 cm; primary lateral veins 3 or 4 per side, departing midrib at 60–65° angle, arcuate to the collective vein, drying raised on both surfaces; interprimary veins, secondary and tertiary veins drying prominent; reticulate veins drying prominulous; collective vein arising from one of the lower basal veins, weakly sunken above, prominulous below, 2–6 mm from the margin. INFLORESCENCE longer than the leaves; peduncles 53–74 cm long, terete, longer than the petioles; spathe white, broadly ovate to obovate, 10–13 cm long, 5.5–7.2 cm wide, broadest usually at middle, caudate at apex (the acumen 2 cm or longer), rounded to cordate and clasping at base; spadix sessile, pink, slightly tapered, bluntly rounded at apex, 7–9 cm long, 7–9 mm diam. at base, ca. 5 mm diam. near apex; flowers rhombic to sub-4-lobed, 1.6–1.8 mm long, 1.7–1.9 mm wide, 8–9 flowers visible in the principal spiral, 12–14 flowers visible in the alternate spiral, the sides sigmoid; tepals semiglossy, the lateral tepals ca. 1 mm wide, the inner margins drying upturned and concave; pistils not emergent; stamens (dried) possibly retracted; anthers 0.5 mm long, 0.5 mm wide; thecae ovoid, slightly divaricate. INFRUCTESCENCE with white berries (fide *Hammel 1168,* not seen). Fig. 126.

Anthurium sapense is endemic to Panama in the Serranía del Sapo in southwestern Darién Province at about 1,000 m in what was probably premontane rain forest life zone.

The species is a member of section *Calomystrium* and is unusual for members of this section in being somewhat scandent with the lower internodes elongate (Hammel, pers. comm.). It is also distinguished by its prominently lobed leaves with narrow posterior lobes almost as long as the anterior lobe, its intact, persistent cataphylls, and especially by its broad, white, caudate-acuminate spathe and slightly tapered, pink spadix. This species has no close relatives.

Anthurium sapense is named for the type locality on Cerro Sapo.

DARIÉN: Cerro Sapo, *Hammel 1167, 7259* (MO), *1168* (MO, PMA).

Anthurium scandens (Aubl.) Engl., Mart. Fl. Bras. 3(2): 78. 1878.

a. Anthurium scandens ssp. **scandens.** *Dracontium scandens* Aubl., Hist. Pl. Guiane 2: 836. 1775. TYPE: French Guiana. Drawing by Plum. in Amer. Nascentium Icon. t. 74. 1703 (BM, P).

Pothos violacea Swartz, Prod. Veg. Ind. Occ. 32. 1788. *Anthurium violaceum* (Swartz) Schott, Melet. 22. 1832. TYPE: Jamaica, *Swartz s.n.* (not seen).

Dracontium repens Descourt., Fl. Méd. Antilles 7: t. 499. 1829. TYPE: Plate 499 serves as the type.

Anthurium violaceum fo. *latifolia* Kunth, Enum. Pl. 3: 68. 1841. TYPE: (not seen).

Anthurium violaceum fo. *angustifolia* Kunth, Enum. Pl. 3: 68. 1841. TYPE: (not seen).

Anthurium leucocarpum Schott, Oesterr. Bot. Wochenbl. 7: 53. 1857. TYPE: Mexico, *Schiede s.n.* (not seen, Photos of Schott Aroid Drawings #279; NYBG Neg. #N.S.3804 and #282; NYBG Neg. #N.S.3805).

Anthurium dolosum Schott, Oesterr. Bot. Z. 8: 179. 1858. TYPE: Guatemala. Near San Pedro and San Lucia, *Wendland 273* (GOET, hololectotype; K, isolectotype).

Anthurium rigidulum Schott, Oesterr. Bot. Z. 8: 180. 1858. LECTOTYPE: Costa Rica. San José, *Hoffmann 508* (Photo of Schott Aroid Drawing #270; NYBG Neg. #N.S.3807).

Anthurium virgosum Schott, Oesterr. Bot. Z. 9: 100. 1859. TYPE: Brazil. Río de Janeiro, *Riedel s.n.* (K).

Epiphytic creeper; stems usually less than 1 m long; internodes elongate, cataphylls drying brown, weathering to reticulate fibers and persisting around stem; petioles sharply sulcate, rounded abaxially, 2–8.5 cm long, 2–3 mm diam.; blades ovate-elliptic to lanceolate-elliptic, moderately thick, (3.5–)6–13 cm long, (1.5–)2–5 cm wide, acute to rounded at base; lower surface conspicuously brown punctate. Inflorescence erect to pendent, peduncle 1.5–6.5 cm long, 1–1.3 mm diam.; spathe pale green, ovate to nar-

rowly ovate, 8–16 cm long, ca. 4 mm wide, reflexed at anthesis; spadix yellow-green, sometimes becoming lavender, 1.3–3 cm long, 2–3 mm diam. midway; berries usually pale violet to almost white, sometimes purple, obovoid, rounded at apex, 5–8 mm wide. See Croat (1983: 371) for a more complete description.

Anthurium scandens is known from southern Mexico and the West Indies to southern Brazil, ranging from sea level to 2,700 m. This is the most widespread aroid in the New World and, doubtless, the most ecologically diverse as well, occurring in tropical moist, premontane wet, tropical wet, premontane rain, and lower montane rain forest life zones.

The species is closely related to *Anthurium trinerve* with which it has long been confused. The differences separating the two species are outlined in the key. *Anthurium scandens* is in section *Tetraspermium* and is most easily distinguished by its spathe, which is reflexed at anthesis, whereas the spathe of *A. trinerve* is consistently erect even after anthesis.

BOCAS DEL TORO: Río Cricamola, *Woodson et al. 1880* (MO).

CANAL ZONE: Barro Colorado Island, *Croat 6803A, 11476* (MO).

CHIRIQUÍ: Bajo Chorro, *Davidson 162* (MO); Bajo Grande, *Nee 10037* (MO); vicinity Boquete, *Blum & Dwyer 2551* (MO, PMA), *Davidson 734* (MO), *Nee 10557* (MO); between Boquete & Monte Rey, *Croat 15824* (MO, NY); vicinity Casita Alta, Volcán de Chiriquí, *Woodson et al. 863, 925* (MO); vicinity Cañas Gordas, *Liesner 276* (MO); along road to Cerro Azul, *Croat 26736* (MO, PMA); Cerro Colorado, *Folsom & Mauseth 8434* (MO); Cerro Horqueta, *Cochrane et al. 6245* (DUKE, MO, WIS), *Dwyer et al. 503* (MO); Cerro Punta, *Croat 16128* (MO), *Tyson 5803* (MO, PMA), *Wilbur et al. 13136* (MO); road between Concepción & El Hato del Volcán, *Croat 26255* (MO); Finca Ojo de Agua, *Knapp 1455* (MO); Fortuna Dam site, *Folsom et al. 5617* (MO), *Stevens 18412* (MO); slope of La Popa, above Boquete, *D'Arcy & D'Arcy 6447* (MO); N of Las Nubes, *Wilbur et al. 15237* (MO).

COCLÉ: slope of Cerro Pilón, *Duke 12138* (MO); 9 km from El Valle market beyond Furlong's Finca, *Kennedy et al. 3212* (MO); El Copé, *Antonio 1155, 3274* (MO); La Mesa above El Valle, *Croat 25291* (MO, PMA), *Gentry 7413* (MO), *Nee & Hale 9611* (US); mountains beyond La Pintada, *Hunter & Allen 577* (MO).

COLÓN: Santa Rita Ridge Road, *Correa & Dressler 789* (MO).

DARIÉN: Cerro Pirre, *Bristan 1242* (MO); Cerro Sapo, *Hammel 1280* (MO); Tres Bocas on Río Cuasí, *Kirkbride & Duke 1373* (MO).

PANAMÁ: Cerro Campana, *Antonio 1710* (MO), *Folsom et al. 2303* (MO), *Liesner 631* (MO), *Porter et al. 4275* (MO), *Tyson 5329* (MO); Cerro Jefe, *Witherspoon & Witherspoon 8513* (MO); El Llano-Cartí Road, *Mori & Kallunki 2258* (MO).

VERAGUAS: Río Segundo Brazo, *Croat 25547* (MO, PMA); beyond Río Tres Brazo, *Croat 25588* (MO); W of Santa Fe, *Croat 23091* (MO), *Nee 9868, 11187* (MO).

b. Anthurium scandens ssp. **pusillum** Sheffer, Aroideana 3: 86. 1980. TYPE: Costa Rica. Cartago: SE of Tapantí, Río Grande de Orosí, 1,400 m, 16 Apr. 1967, *Lent 830* (F, holotype).

Subspecies *pusillum* differs from the typical subspecies in usually having a much smaller spadix (usually with fewer than 13 flowers), usually 2–10 mm long.

Anthurium scandens ssp. *pusillum* occurs from Honduras to Colombia and Venezuela at elevations of 600 to 2,500 m in lower montane moist, premontane wet, lower montane rain, and premontane rain forest life zones.

Sheffer (1974) believes that the subspecies may represent one of the diploids upon which the polyploid complex has been built.

CHIRIQUÍ: vicinity Bajo Mono & Quebrada Chiquero, *Woodson & Schery 570* (MO); between Boquete & Monte Rey, *Croat 15825* (MO); Cerro Colorado, *Croat 37093, 37202* (MO); Cerro Hornito, *Hammel 3036* (MO); Cerro Punta, *Croat 13698* (MO), *Stevens 18161* (MO), *Sytsma & Stevens 2124* (MO, PMA); Fortuna Dam site, *Correa et al. 2634* (MO), *Sytsma & Stevens 2299* (MO); between Gualaca & Fortuna Dam site, *Antonio 2843, 4074* (MO), *Croat 49978* (MO, PMA); La Popa above Boquete, *D'Arcy 10972* (MO); Las Nubes, *Croat 26443* (MO).

COCLÉ: Alto Calvario, *Folsom & Jaslon 2670* (MO); Cerro Pilón, *Duke 12120, 12140* (MO), *Duke & Dwyer 13919* (MO); El Copé, *Antonio 1178* (MO), *Folsom et al. 8283* (MO); above El Potroso, *Sytsma 1765* (MO); El Valle de Antón, *Lewis et al. 2517* (MO), *Luteyn & Kennedy 1614* (DUKE, MO), *Luteyn 4052* (DUKE), *Kennedy et al. 3217* (MO), *Maas et al. 1734* (MO); vicinity La Mesa, *Folsom & Raul 5626* (MO), *Gentry 6863* (MO), *Kennedy et al. 2101* (MO), *Nee & Hale 9611* (MO).

DARIÉN: Cerro Pirre, *Duke & Elias 13701* (MO).

PANAMÁ: Cerro Campana, *Croat 14712* (MO), *Kirkbride & Hayden 306* (MO), *Porter et al. 4917* (MO); El Llano-Cartí Road, *Liesner 664* (MO, NY).

VERAGUAS: Cerro Tute, *Sytsma & Antonio 3004* (MO); vicinity Santa Fe, *Croat 23196* (MO), *Liesner 950* (MO), *Mori & Kallunki 2583* (AAU, MO), *Mori et al. 3992* (MO), *Mori 6653* (MO).

Anthurium seibertii Croat & Baker, Brenesia 16(Supl. 1): 85. 1979. TYPE: Panama. Chiriquí: wooded slopes on Cerro Horqueta, 1,650 m, *Croat 26976* (MO 2251853, ho-

lotype; B, CR, F, K, NY, PMA, US, isotypes; Live at MO).

Epiphytic; stems thick, short, 3–6 cm diam.; cataphylls drying tan, splitting at base, the apex remaining more or less intact; petioles 10–55 cm long, 6–10 mm wide, more or less quadrangular, 5-ribbed; blades strap-shaped, obtuse to slightly rounded at base (20–)45–85 cm long, 4–16 cm wide. Inflorescence erect or spreading; peduncle (15–)30–60 cm long, (4–)6–10 mm diam., terete with a single dorsal rib, sometimes tinged purplish; spathe medium thick, green or green tinged with purple, oblong-lanceolate, rarely narrowly ovate, (6–)10–17 cm long, (2.3–)2.5–4.3 cm wide; spadix purple, (6–)10–20 cm long, (6–)7–13 mm diam. at base; berries orange, obovoid, flat to rounded at apex, 10–12 mm long; seeds 2. See Croat (1983: 381) for a more complete description.

Anthurium seibertii is known from higher elevations in Chiriquí Province (1,300 to 2,000 m) and from two collections from Costa Rica, one made at 1,040 m in San José Province [*Skutch 2626* (MO, US)] and a second from Limón Province in Valle de Silencio at approximately 2,000 m [*Antonio 1675* (MO)].

The species is a member of section *Pachyneurium* and is very similar to *Anthurium protensum*. They share similar strap-shaped leaves, purple spadices, and orange berries. *Anthurium protensum* differs in having a nearly terete petiole, while *A. seibertii* has petioles that are rectangular and prominently ribbed abaxially. *Anthurium protensum* also has leaves that are usually pendent and generally smaller than those of *A. seibertii*.

CHIRIQUÍ: Bajo Chorro, *Davidson 225, 276* (MO); vicinity of Bajo Mono & Quebrada Chiquero, *Woodson & Schery 599* (MO); lower N slope of Barú, *Hammel 2994* (MO); Boquete, *Folsom 2194* (MO), *Hammel 5667* (MO); vicinity Casita Alta, Volcán de Chiriquí, *Woodson et al. 882, 982* (MO); Cerro Horqueta, *Croat 26976* (B, CR, F, K, MO, NY, PMA, US), *Cochrane et al. 6243* (MO, WIS), *Dwyer et al. 553* (MO), *Dwyer 8749* (DUKE, MO); vicinity Cerro Punta, *Croat 10551, 10555* (MO), *48568* (K, MO, PMA, SEL), *Croat & Porter 16063* (M, MO, RSA, U, VEN), *Folsom 6034, 6035* (MO), *Hammel et al. 6623* (MO), *Lazor 2727* (MO), *Luteyn 902* (MO), *Nee 9945* (MO), *Stevens 18226* (MO); forested hill N of Audubon cabin, *Croat 13618* (MO); La Popa above Boquete, *D'Arcy 10853* (MO); Las Nubes, *Croat 26427* (MO), *26494* (B, CAS, DUKE, K, MO); vicinity Monte Lirio, *Allen 1506* (MO), *Seibert 172* (MO, NY), *289* (MO); Monte Rey near Boquete, *Croat 15743* (MO, NY), *15844* (MO); Palo Alto, *Hammel 7464* (MO), *Stern et al. 1076* (MO); Quebrada Velo, *Woodson & Schery 265* (MO); near Volcán, *Antonio 1059* (MO).

Anthurium spathiphyllum N. E. Brown, Gard. Chron. 7: 652. 1877. TYPE: Origin unknown: Hort. Kew, 8 Nov. 1876, *Brown s.n.* (K).

Epiphyte; stems ca. 10 cm long, ca. 2 cm diam.; cataphylls drying pale tan, weathering to coarse, longitudinal fibers and persisting; petioles usually triangular, sometimes quadrangular or sharply 3–5-ribbed; blades linear to linear-lanceolate, subcoriaceous, 46–80 cm long, 5.5–12.5 cm wide. Inflorescence spreading; peduncle flattened, 2–4-ribbed, 33–48 cm long, 1–1.5 cm wide; spathe coriaceous, green, lanceolate to broadly lanceolate, 6.5–8 cm long, 1.7–3 cm wide; spadix pale yellow to creamy white, (1.7–)3–4 cm long, 0.9–1.1 cm diam. midway; berries unknown. See Croat (1983: 385) for a more complete description.

Anthurium spathiphyllum is known from Nicaragua to Panama from sea level to 380 m on the Atlantic slope in wetter parts of tropical wet forest and in premontane wet and tropical wet forest life zones. One exception is a collection from Costa Rica from a much higher elevation.

Anthurium spathiphyllum is in section *Pachyneurium*. The species can be recognized by its epiphytic habit, its chartaceous leaves, its usually triangular, sometimes three- to five-ribbed petiole, its lanceolate to broadly lanceolate cucullate spathe, and by its short, scarcely tapered, pale yellow spadix.

BOCAS DEL TORO: vicinity Almirante-Changuinola Canal, *Blum 1403* (SCZ); above Railroad Station at Milla 7.5, *Croat & Porter 16276* (MO), *Kennedy 1273* (DUKE).

COCLÉ: Boca del Toabré at confluence of Río Toabré & Río Coclé del Norte, *Lewis et al. 5569* (MO).

Anthurium standleyi Croat & Baker, Brenesia 16(Supl. 1): 88. 1979. TYPE: Costa Rica. San José: ca. 5 mi. SW of Canaán along gravel road from Rivas, steep slopes, ca. 900 m, *Croat 43439* (MO 2582987, holotype; B, CAS, CR, F, GH, K, M, NY, PMA, RSA, SEL, UC, US, VEN, isotypes; Live at MO).

Terrestrial ca. 1.75 m tall; stems to 90 cm long, 3–5 cm diam.; cataphylls curled into a tubular cylinder, drying tan, weathering into long, subpersistent fibers; petioles 43–120 cm long, 7–16 mm diam., terete; blades ovate, moderately thin,

lobed at base, 40–75 cm long, 25–56 cm wide. Inflorescence erect to spreading; peduncle 29–76 cm long, 4–9 mm diam., terete; spathe moderately thick, green, oblong-lanceolate, 10.5–18 cm long, 2–4 cm wide; stipe 6–60 cm long; spadix green becoming tinged with violet purple, turning yellowish brown, 10–30 cm long, 7–10 mm diam. at base; berries orange, broadly ovoid, rounded at apex; seeds 2. See Croat (1983: 390) for a more complete description.

Anthurium standleyi is known for certain only from Costa Rica in the Cordillera de Talamanca. It was first collected by Paul Standley at two sites, La Verbena and San Sebastian south of San José in what is probably premontane wet forest. It has been collected more recently in the region northeast of San Isidro del General. The species ranges from 900 to 1,900 m and may be restricted to premontane wet forest.

The species is a member of section *Pachyneurium.*

A cultivated collection from the University of Hawaii was reportedly based on a Dressler collection from Achiote, a region of tropical moist forest in the Isthmus of Panama. The species has never been collected in Panama to our knowledge and the collection cultivated in Hawaii is possibly mislabelled.

Anthurium subrotundum Croat, sp. nov. TYPE: Panama. Darién: Serranía de Pirre, along Río Escucho Ruido ca. 16 km N of Alturas de Nique at ca. 8°48′N, 77°44′W, lower montane rain forest, 1,530–1,550 m, *Croat 37951* (MO 2416723, holotype; B, K, PMA, SEL, US, isotypes).

Planta terrestris, repens aut erecta; internodia 1–4 cm long; cataphyllum membranaceum, persistens plus minusve intactum; petiolus subteres, sulcatus, 14–17 cm longus; glanduloso-punctatus; lamina crasse chartacea, late elliptica ad plus minusve rotunda, basi rotundata aut late obtusata, 10–11.5 cm longa, utrinque glanduloso-punctata; inflorescentia foliis breviora; pedunculus 4–5 cm longus; spatha viridis ad alba, modice membranacea, oblongo-lanceolata, 1.2–1.4 cm longa, 3–4 mm lata; spadix pallide viridis ad albus, 1.5–2 cm longus; baccae ignotae.

Terrestrial in deep debris, creeping to erect; stems to ca. 80 cm long, 4–6 mm diam.; the internodes elongate, 1–4 cm long; leaf scars inconspicuous; roots relatively few, slender; cataphylls thin, drying pale reddish brown, promptly weathering but remaining more or less intact with fibers exposed, finally deciduous. LEAVES bicolored, long-petiolate, scattered on upper part of stem only; petioles subterete, sulcate, 14–17 cm long, ca. 3 mm diam., glandular-punctate on surface, much longer than the blades; blades thickly chartaceous (dry), broadly elliptic to almost orbicular, rounded or broadly obtuse at apex, ending abruptly with a short, downturned point, rounded to broadly obtuse at the base, ending abruptly on the petiole and briefly decurrent, 10–11.5 cm long, 7.5–8.5 cm wide; both surfaces semiglossy, the upper surface inconspicuously glandular-punctate (the glands not sunken), drying greenish brown; lower surface conspicuously and densely glandular-punctate, drying pale brown; midrib prominently raised on both surfaces; primary lateral veins 8–10 per side, departing the midrib at 65–90° angle (though often turning down along the midrib just before joining the midrib) on the same blade, the lowermost more broadly spreading than the upper veins, scarcely raised above, prominulous below; interprimary veins usually much weaker than the primary lateral veins; collective vein arising from near the base, extending to the apex, 3–6 mm from the margin, weakly sunken above, prominulous below, rather prominently loop-connecting the primary lateral veins. INFLORESCENCE much shorter than the leaves; peduncle 4–5 cm long, ca. 2 mm diam.; spathe green to white, moderately thin, oblong-lanceolate, 1.2–1.4 cm long, 3–4 mm wide, abruptly acuminate at apex, acute to rounded at base, inserted at ca. 45° angle on peduncle; stipe to 1.5 mm long; spadix short, pale green to white, scarcely tapered, 1.5–2 cm long, ca. 2.5 mm diam., flowers rhombic, 3.6–4 cm long, ca. 3 mm wide, ca. 2 flowers visible in the principal spiral, 3–4 flowers visible in the alternate spiral; tepals semiglossy, lateral tepals 2.5–2.6 mm wide, the inner margin almost straight; pistils not emergent; stamens 0.4 mm wide, retracted beneath the tepals after anthesis. INFRUCTESCENCE not known. Fig. 157.

Anthurium subrotundum is endemic to the Serranía de Pirre in western Darién Province in lower montane rain forest at 1,350 to 1,550 m and is known only from the type collection.

The species, a member of section *Porphyrochitonium,* is distinguished by its terrestrial habit, its elongate slender stems with weathered, reddish brown cataphylls persisting at the upper nodes, its petioles that are much longer than the blades, its broadly ovate to suborbicular leaves

that are rounded at the apex with a single collective vein, and especially by its green to white spathe and spadix. It is apparently most closely related to *Anthurium collinsii* from the Serranía de Cañasas that differs in having conspicuously acuminate blades and a reddish spathe and spadix. The species is also related to *A. melastomatis* from the El Copé (Coclé) region that differs in having three collective veins on each side of the blade.

The name of the species (*subrotundum*) refers to the shape of the leaves.

DARIÉN: Serranía de Pirre, N of Alturas de Nique, *Croat 37951* (B, K, MO, PMA, SEL, US).

Anthurium supraglandulum Croat, sp. nov. TYPE: Panama. Panamá: Cerro Jefe, at summit, ca. 1,000 m, 15 mi. from Pan-American Hwy., *Croat 49087* (MO 2737333, holotype; PMA, isotype; Live at MO).

Planta epiphytica; cataphyllum membranaceum persistens in fibris tenuibus; petiolus subteres, complanatus aut sulcatus adaxiale, sulco cum costa media; lamina oblongo-elliptica, raro oblanceolato-elliptica aut ovata, basi acuta, 6–19 cm longa, 2.3–8.5 cm lata, utrinque dense glanduloso-punctata; inflorescentia foliis longiora; pedunculus 10–35 cm longus; spatha membranacea, viridulo-alba, oblongo-elliptica, 1.3–3.5 cm longa (raro 8 cm longa), 8–16 mm lata; spadix plerumque sessilis, violaceus purpureus, 2–12(–17) cm longus; baccae ignotae.

Epiphyte; stems less than 15 cm long, ca. 8 mm diam.; leaf scars ca. 5 mm diam., inconspicuous; cataphylls thin, 1.5–3 cm long, rounded at apex with subapical apiculum, drying reddish brown, weathering to fine persistent fibers. LEAVES erect; petioles 2–29 cm long, 2.5–5 mm diam., subterete, flattened to sulcate adaxially with a faint medial rib, the margins erect; geniculum ca. 1 cm long; blades oblong-elliptic, rarely oblanceolate-elliptic or ovate, bluntly acuminate at apex, rarely acuminate or rounded (the acumen apiculate, downturned), acute at base, 6–19 cm long, 2.3–8.5 cm wide, usually broadest at the middle or above; upper surface semiglossy, densely glandular-punctate (the glands sunken), the epidermal cells convex, lower surface only slightly paler and less densely dark glandular-punctate; midrib prominently convexly raised above, diminished and sunken near apex, convexly raised below; primary lateral veins (3–)5–6 per side, departing midrib at 30–45° angle, straight to collective vein, weakly etched into surface above, prominulous below; interprimary veins drying equally as prominent as primary lateral veins; collective vein arising from the base, 2–8 mm from margin, weakly sunken above, prominulous below, a secondary collective vein sometimes joining margin in lower third of blade. INFLORESCENCE usually longer than leaves; peduncle 10–35 cm long, 1–3 mm diam., (1.5–)3–6 times longer than petioles; spathe thin, greenish white, oblong-elliptic, more or less boat-shaped, 1.3–3.5 cm long (rarely to 8 cm long), 8–16 mm wide, broadest in the lower third, rounded and apiculate at apex, the margins acute or overlapping at base, decurrent on peduncle, inserted at ca. 45° angle on peduncle; spadix sessile or rarely with stipe to 3 mm long, violet purple (B & K Red-purple 3/10), scarcely tapered toward apex, 2–12(–17) cm long, 3–6 mm diam. midway, 2–4 mm diam. near apex; flowers square to rhombic, 1.7–3.4(–4.2) mm long, 1.3–2.8 mm wide, the sides straight to weakly sigmoid, 3–4 flowers visible in the principal spiral, 5–6 visible in the alternate spiral; tepals matte, minutely papillate, lateral tepals 0.6–1.1 mm wide, the inner margins broadly rounded; pistils not emergent, pinkish white; stamens probably emerging in a regular manner, promptly retracting beneath tepals after anthesis; anthers white, 0.4 mm long, 0.6 mm wide, held briefly above the tepals; thecae ovoid, slightly divaricate; pollen white. INFRUCTESCENCE not known. Fig. 146.

Anthurium supraglandulum is endemic to central Panama and appears to be restricted to the region of Cerro Jefe at 600 to 1,000 m in tropical wet and premontane rain forest.

The species, a member of section *Porphyrochitonium*, is characterized by its epiphytic habit and small size, its short stem with persistent weathered cataphylls, and by its petioles that are generally shorter than the blades. It is also distinguished by its elliptic or oblong-elliptic to oblanceolate-elliptic, acute to bluntly acuminate blades that are conspicuously glandular punctate on the upper surface and usually have a single pair of collective veins, but is most distinguished by its purple spadix and a peduncle that equals or usually greatly exceeds the length of the petioles.

Anthurium supraglandulum is most easily confused with *A. bicollectivum* and especially *A. jefense*, both of which have been collected in the Cerro Jefe region. *Anthurium bicollectivum* differs by its generally larger leaves, usually with

prominent secondary collective veins and especially by its green rather than purple spadix.

Anthurium jefense shares with *A. supraglandulum* a dark violet purple spadix but differs in having lanceolate-elliptic to oblong-elliptic blades that are more prominently acuminate and lack the glands on the upper surface typical of *A. supraglandulum*. *Anthurium jefense* has white berries, but the berries of *A. supraglandulum* are still unknown.

Folsom et al. 1860 differs from all other specimens of *Anthurium supraglandulum* in having small ovate leaf blades that are broadly rounded at the base. Nevertheless, it has the same leaf texture and type of inflorescence.

PANAMÁ: Cerro Jefe, *Antonio 4721, 4740* (MO), *Croat 49087* (MO, PMA), *Folsom et al. 1859, 1860* (MO), *Folsom 2530* (MO), *Folsom & Mauseth 7793B* (MO), *Hammel 3728* (MO), *Kennedy 1167* (DUKE), *Mori & Kallunki 2393* (MO), *Mori et al. 3752* (MO, PMA, WIS), *Mori 7983* (MO), *Sytsma 1479, 1515* (MO), *Tyson et al. 4384* (SCZ), *Witherspoon 8533* (MO); La Eneida, *Correa 820* (MO).

Anthurium sytsmae Croat, sp. nov.[3] TYPE: Panama. Coclé: area between Caño Blanco del Norte, Caño Sucio and Chorro del Río Tife, 8°42′19″–8°43′06″N, 80°36′30″–80°38′W, 200–400 m, evergreen forest, *Davidse & Hamilton 23578* (MO 3099552, holotype; K, PMA, isotypes).

Planta epipetric; caules ca. 10 cm longi; cataphylla 6–9 cm longa, persistens superis nodis fibris tenuibus, postremo deciduis; petioli 13–18 cm longi, 2–3 mm lati, anguste sulcati; lamina subcoriacea, oblongo-oblanceolata, 19–25 cm longa, 3–4.5 cm lata; inflorescentia erecta, longiora quam petiola; pedunculus 13–16 cm longus; spatha oblongo-lanceolata, viride, reflexens prominenter; spadix stipitata 2–3 mm, viridula brunnea (probabliter per anthesin), 7.4–9.5 cm longa, 3 mm lata; baccae immaturae viride obovoidea, 6.5–9 mm longae, 4.5–5.5 mm diam., semina dua, 4.5–5 mm longa, 2–2.8 mm lata.

Epipetric; 35–50 cm tall; stems ca. 10 cm long; roots moderately few, descending, ca. 3 mm diam.; cataphylls 6–9 cm long, narrowly pointed at apex, thin, soon weathering to slender, pale brown fibers and persisting loosely at uppermost nodes, eventually falling. LEAVES erect to spreading; petioles 13–18 cm long, 2–3 mm diam., narrowly sulcate; geniculum 1.3–1.5 cm long; blades subcoriaceous, oblong-oblanceolate, 19–25 cm long, 3–4.5 cm wide, gradually acuminate at apex (the acumen 1–2 cm long, apiculate ca. 1 mm), narrowly acute at base, epunctate below, drying yellowish brown, sparsely and obscurely glandular-punctate above, drying grayish brown; midrib raised below, weakly raised above; primary lateral veins 5–7 per side, prominently ascending, departing midrib at 15–30° angle, drying scarcely more prominent than the interprimary veins; reticulate veins drying prominulous on upper surface, prominent on lower surface; collective vein arising from one of the primary lateral veins in the middle to lower third of the blade. INFLORESCENCE erect, usually longer than the petioles; peduncles 13–16 cm long; spathe oblong-lanceolate, 2.7–4.7 cm long, 5–10 mm wide, green, at first erect, becoming prominently reflexed, narrowly acuminate at apex (the acumen 1–6 mm long, inrolled), inserted at ca. 45° angle; spadix stipitate 2–3 mm, greenish brown (probably at anthesis), narrowly oblong, scarcely or not at all tapered, 7.4–9.5 cm long, 3 mm diam. (dried), bluntly rounded at apex; flowers rhombic, 2.2–2.5 mm long, 1.9–2.2 mm wide, the sides gradually sigmoid; 3 flowers visible in the principal spiral, 5–6 flowers visible in the alternate spiral; tepals drying glossy, lateral tepals 1.3–1.4 mm wide, inner margins convex, thin; pistils not at all emergent, green; stigma slitlike, 0.3 mm long, the space between the tepals 0.3–0.4 mm wide; staminal emergence not studied, stamens apparently retracting (at least on drying); anthers 0.3 mm long; thecae oblong-ovoid, slightly divaricate. INFRUCTESCENCE spreading; spathe persistent; berries green, obovoid, round at apex, 6.5–9 mm long, 4.5–5.5 mm diam., periderm thick, lacking obvious raphide cells; seeds 2, 4.5–5 mm long, 2–2.8 mm wide, somewhat flattened, enveloped in a gelatinous substance.

Anthurium sytsmae is endemic to Panama in Coclé Province occurring in tropical wet forest. It is only known from rapidly flowing streams at 200 to 400 m where it grows on rocks along the stream margins or in the spray basin of waterfalls.

The species is a member of section *Porphyrochitonium* and is probably most closely related to *A. amnicola,* which is also only sparsely and obscurely punctate on the upper surface, and *A. antioquiense* Engl. from Colombia, which is only sparsely punctate.

It is the third riparian species to be discovered

[3] This species was not described until after this manuscript was submitted and is therefore not accompanied by a photograph.

in recent years from rapid flowing streams on the Caribbean slope of Coclé Province (the other two being *Anthurium rupicola* and *A. amnicola*). It differs from both of these species in that it has prominent reticulate venation. Although this venation is closest to that of *A. amnicola,* the latter species has an ovate, pale lavender spathe and much shorter, violet purple spadix. It differs from *A. rupicola* in having the collective vein arising from one of the primary lateral veins in the middle of the blade; *A. rupicola* has the collective vein arising from the base of the blade.

Anthurium sytsmae was collected in flower and fruit in February and is named for Kenneth Sytsma who made the first collection in 1982. That collection disappeared shortly after arriving and has not yet resurfaced. Fortunately Gerrit Davidse was planning a trip into the area the following year and agreed to look for the plant. Its rediscovery allows the description to be prepared.

COCLÉ: between Caño Blanco del Norte, Caño Sucio, & Chorro del Río Tife, *Davidse & Hamilton 23578* (K, MO, PMA), *23639* (MO); vicinity of waterfall of Río Tife, base of Cerro Tife, *Knapp 3699* (MO, US).

Anthurium tacarcunense Croat, sp. nov. TYPE: Panama. Darién: Cerro Tacarcuna; along stream N of summit camp, 1,550–1,650 m, lower montane wet forest life zone, *Gentry & Mori 14075* (MO 2275353, holotype; PMA, isotype).

Planta plerumque epiphytica, interdum terrestris; cataphyllum persistens fibris, apice interdum intactum; petiolus teres, 7–14 cm longus; lamina oblanceolata, siccitate modice coriacea, basi anguste acuta ad attenuata, utrinque glanduloso-punctata, 10.5–19 cm longa, 4.2–7.3 cm lata; inflorescentia erecta; pedunculus 7–17 cm longus, teres aut raro tricostatus; spatha modice membranacea viridis, lanceolata, 2.5–4.3 cm longa, 5–10 mm lata; spadix viridis, 5–7 cm longus; baccae albae, ovoido-ellipsoideae, 1.8–2.2 mm longae.

Usually epiphytic, sometimes terrestrial, 35–45 cm tall; stem to 20 cm long, 8–10 mm diam.; roots numerous, 2–3 mm diam., descending; cataphylls narrowly triangular, 2.5–4 cm long, acute to narrowly rounded at apex with short subapical apiculum, drying reddish brown, weathering to persistent fibers, sometimes more or less intact at apex. LEAVES semierect; petioles 7–14 cm long, 2–3 mm diam., terete; geniculum 1–1.5 cm long; blades oblanceolate, drying moderately thick, obtuse at apex (acumen short and flat), narrowly acute to attenuate at base, 10.5–19 cm long, 4.2–7.3 cm wide; both surfaces semiglossy, the upper surface inconspicuously glandular-punctate, the lower surface paler, glandular-punctate; midrib raised on both surfaces; primary lateral veins 8–12 per side, departing midrib at 40–50° angle, straight or weakly curved to collective vein, prominulus above and below (dry); interprimary veins drying only slightly less conspicuous than primary lateral veins; collective vein arising from the base, 3–5 mm from margin, scarcely visible above, prominulous below (dry). INFLORESCENCE erect; peduncle 7–17 cm long, 2–3 mm diam., terete or rarely 3-ribbed; spathe moderately thin, green, lanceolate, 2.5–4.3 cm long, 5–10 mm wide, broadest just above the base, inserted at ca. 45° angle on the peduncle; spadix green, 5–7 cm long, 2.5–3.5 mm diam. at base, 2–2.5 mm diam. at apex; flowers rhombic, 2.8–3 mm long, 2–2.5 mm wide, 2–3 flowers visible in the principal spiral, 5–6 flowers visible in the alternate spiral; lateral tepals 1.4–1.6 mm wide, the inner margins broadly rounded; pistils weakly emergent, green; stigmas oblong-elliptic, ca. 0.25 mm long; stamens retracting after anthesis; flowers drying thick and semi-intact. INFRUCTESCENCE with spadix 8–9 cm long; berries white, subglobose, rounded at apex; mesocarp with whitish raphide cells in upper one-half of berry; seeds 2, greenish white, ovoid-ellipsoid, oblique at apex, rounded at base, 1.8–2.2 mm long, 1.2–1.4 mm wide, ca. 1 mm thick, enveloped in a sticky, gelatinous, transparent sac, thickest along one side and at ends. Fig. 136.

Anthurium tacarcunense is apparently endemic to Cerro Tacarcuna in Darién Province of Panama at 1,550 to 1,850 m, occurring in lower montane wet and elfin forest. It is naturally to be expected in adjacent Colombia.

The species is in section *Porphyrochitonium* and is recognized by its slender, densely rooted stems, its persistent, weathered cataphylls, its long-petiolate, oblanceolate, glandular-punctate leaves with the interprimary veins about equally as prominent as the primary lateral veins, and by its lanceolate spathe, slender green spadix, and white berries.

It is closest to *Anthurium terryae* of the Serranía de Pirre, which shares a green spathe and white berries. The latter differs in having the primary lateral veins more remote from one another

and lacking prominent interprimary veins. In addition *A. terryae* has stamens that remain exposed after anthesis and are exserted on dried specimens.

Folsom and Collins 6660 from the Serranía de Cañasas is perhaps also this species, but the leaf blades lack the prominent interprimary veins. Another collection that has similar flowers is *Hartman et al. 4639* from Cerro Pirre, but this collection has leaf blades similar to those of *Anthurium crassitepalum,* which are only scarcely broader toward the apex. The specimen has been placed provisionally in *A. tacarcunense.*

DARIÉN: Cerro Tacarcuna, *Gentry & Mori 14029* (MO), *14075* (MO, PMA), *Gentry et al. 16935* (COL, MO).

PANAMÁ: mountains of Tortí Arriba, *Folsom et al. 6660* (F, MO, PMA, US).

Anthurium teribense Croat, sp. nov. TYPE: Panama. Bocas del Toro: Río Teribe, between Quebrada Treglo and Puerto Palenque, 90–105 m, *Kirkbride & Duke 529* (MO 2132040, 2817264, holotype; NY, isotype).

Planta epiphytica; petiolus quadrangulatus, plus quam 20 cm longus, paginae late sulcatae; lamina ovata, siccitate subcoriacea, basi profunde cordata, 73–96 cm longa, 58–63 cm lata, nervis primariis lateralis numerosis; pedunculus teres plus quam 24 cm longa; spatha viridis, decidua; spadix purpureus; baccae maturae ignotae.

Epiphyte; stem not seen. LEAVES with petioles more than 20 cm long, quadrangular, winged, drying broadly sulcate on all 4 sides, narrowly and deeply sulcate adaxially near the apex, drying faintly reddish brown; geniculum 2–2.5 cm long; blades narrowly ovate, drying thinly coriaceous, greenish brown above, faintly reddish brown below; acuminate at apex, deeply lobed at base, 73–96 cm long, 58–63 cm wide, broadest at point of petiole attachment; anterior lobe 60–77 cm long, convex along the margin, the posterior lobes 27–29 cm long (from apex of sinus to outermost point), curved downward; sinus parabolic, ca. 20 cm deep, about as broad as deep, rounded at apex; both surfaces drying matte; midrib raised above and below, drying sharply 3-ribbed below, becoming 1-ribbed toward the apex; basal veins to 9 or 10 pairs, the first pair free to the base, the sixth to tenth coalesced to 14 cm, the posterior rib broadly curved, turned up along the margin; primary lateral veins to ca. 20 per side, raised in shallow valleys on upper surface, acutely raised below, departing midrib at 50–65° angle; interprimary veins much less prominent than the primary lateral veins; secondary and tertiary veins prominulous below; collective veins apparently rising from one of the lower basal veins (not possible to be certain owing to poor preservation of specimens). INFLORESCENCE with peduncle terete, 24 or more cm long, spathe green, deciduous, spadix purple; flowers square, the normal sized flowers (i.e., those lacking developing berries) 2.5–3 mm long (dry); 12–14 flowers visible in the principal spiral; tepals semiglossy, the lateral tepals concave, weakly turned up, the alternate pair with the inner margins concave, prominently turned up. INFRUCTESCENCE with immature berries exserted, rounded at apex, mature berries not seen. Figs. 171 and 172.

Anthurium teribense is endemic to Panama, known only from the somewhat incomplete type collection in Bocas del Toro Province at about 100 m in what was probably premontane wet or tropical wet forest life zones.

The species is probably a member of section *Belolonchium* but its placement is tentative pending studies with living material. It is recognized by its large narrowly ovate leaf blade, its numerous primary lateral veins, its quadrangular petiole, its faintly reddish brown coloration on the lower surface of the leaf, and by its purplish infructescence. No other species has this combination of characters, and the quadrangular-winged petiole in particular is distinctive.

BOCAS DEL TORO: Río Teribe, between Quebrada Treglo & Puerto Palenque, *Kirkbride & Duke 529* (MO, NY).

Anthurium terryae Standl. & L. O. Wms., Ceiba 3: 106. 1952. TYPE: Panama. Darién: rain forest, E slope, Cana-Cuasí Trail, Chepegana Dist., Provincia Real, 1,650 m, 16 Mar. 1940, *Terry & Terry 1595* (F).

Epiphyte; stems 4–10 cm long, 5–10 mm diam.; roots thin, green, descending; cataphylls thin, 2–2.5 cm long, rounded at apex, drying brown, weathering into fine, persistent fibers. LEAVES erect-spreading; petioles 4–14 cm long, 2–4 mm diam., subterete, sharply sulcate adaxially, conspicuously reddish brown glandular-punctate; geniculum 1–1.5 cm long, scarcely thicker or paler than petiole; blades elliptic to oblanceolate,

chartaceous, acuminate at apex, acute to obtuse at base, 8.5–28 cm long, 2.4–6 cm wide, broadest at middle or just below; both surfaces semiglossy, the upper surface obscurely glandular-punctate, the lower surface much paler and conspicuously black glandular-punctate; midrib convexly raised above, more acute near apex, abruptly sunken at apex, acutely to obtusely raised below; primary lateral veins 10–13 per side, departing midrib at 50–60° angle, sunken in valleys above, raised below, straight or weakly curved to collective vein; interprimary veins scarcely visible; collective vein arising from the base, 2–4 mm from the margin, sunken above, raised below. INFLORESCENCE erect-spreading or pendent; peduncle 13–33 cm long, 2–3 mm diam., terete; to 6 times as long as petioles; spathe chartaceous, pale green, lanceolate, 2–3.5 cm long, 6–7 mm wide, broadest near base, gradually acuminate at apex, rounded at base, inserted at 90° angle on peduncle; spadix yellow-green, 2.1–6.5 cm long, 4–5 mm diam. midway; flowers square, 3.2–3.8 mm in both directions, the sides straight to weakly sigmoid, 3–4 flowers visible in the principal spiral, 8–9 visible in the alternate spiral; tepals glossy, sparsely punctate, densely and minutely papillate with minute droplets; lateral tepals 1–1.2 mm wide, the inner margin concave to straight; pistils emergent, green, glossy; stigmas elliptic; stamens emerging in a slow, regular sequence from the base, laterals preceding alternates by 2–3 spirals; exserted on translucent filaments ca. 0.5 mm long, retracting to hold anthers at edge of tepals; anthers white, persisting, 0.8 mm in both directions; thecae oblong; pollen white. INFRUCTESCENCE with berries white turning purplish, depressed-globose, ca. 6 mm diam.; mesocarp with numerous, short raphide cells; seeds (1–)2–4, ovoid-ellipsoid, greenish white, 2–2.3 mm long, 1.5–1.8 mm wide, ca. 1 mm thick, enveloped by a sticky, transparent, gelatinous envelope, thicker to one side and extending beyond one end. Figs. 162 and 163.

Anthurium terryae is endemic to Panama in Serranía de Pirre in Darién Province from 700 to 1,400 m in premontane rain forest.

The species is in section *Porphyrochitonium* and is distinguished by its narrowly oblanceolate-elliptic, short petiolate blades that dry gray-green to blackened, its subterete, flat-sulcate, margined petioles that are usually one-fifth to one-half as long as the blades (rarely almost as long), its green, reflexed to spreading, lanceolate spathe, its green, relatively short spadix, and by its white to purplish berries.

The inflorescence is variable. Live plants of *Croat 37829* have inflorescences that consistently turn downward on a curved peduncle and are often turned in among the petioles and difficult to see (presumably they are held below the roots in nature). In addition, the spadix is markedly curved. An unnumbered Dillon collection has inflorescences erect with moderately straight spadices.

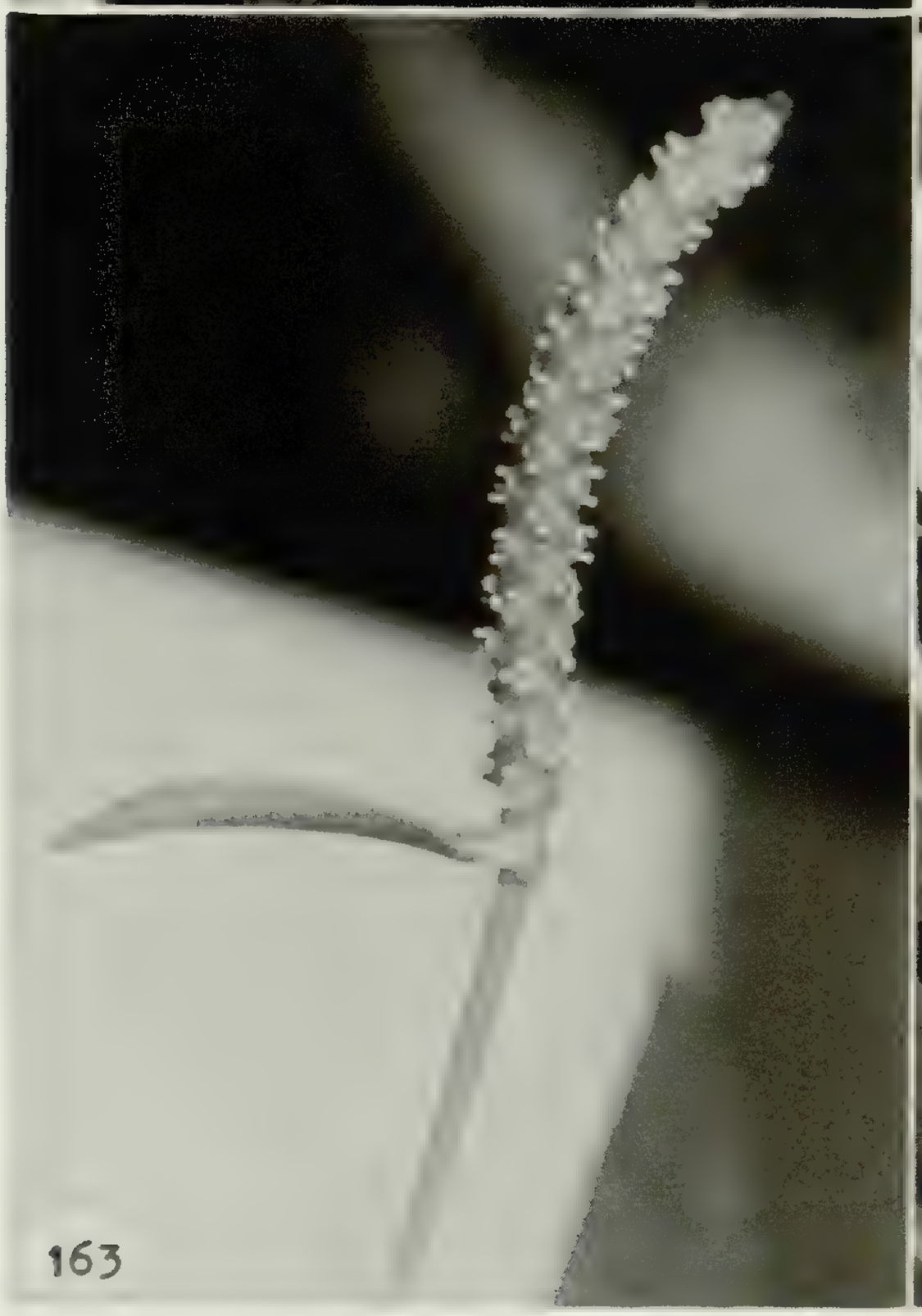
Anthurium terryae is similar to *A. pirrense* with which it occurs on Cerro Pirre (see that species for differences) and also to *A. lactifructum* from the Serranía de Cañasas. The latter differs in having coriaceous, usually more or less elliptic blades with the primary lateral veins not sunken on the upper surface but merely weakly etched. The blades of *A. terryae* are much thinner with the primary lateral veins and the collective veins markedly sunken. *Anthurium pirrense* also differs in having stamens that are not exserted above the tepals and are eventually retracted, whereas those of *A. terryae* are at least initially exserted well above the tepals and persist at the level of the tepals.

Anthurium terryae and *A. crassitepalum* occur in the same region, are of similar size, and have white fruits. The former is distinguished by having leaf blades usually oblanceolate and spadices that frequently dry with the stamens exserted and the tepals not swollen toward their outer margins.

DARIÉN: Alturas de Nique, *Gentry et al. 28721* (MO), *Hartman 12367, 12397, 12429, 12459, 12469* (MO); Cerro Pirre, *Duke 5327, 6117* (MO), *Duke & Elias 13732* (COL, MO), *13824* (DUKE, MO), *Duke 15670* (US), *Folsom 4201, 4278, 4309, 4357A* (MO), *Folsom et al. 6273* (MO), *Folsom & Mauseth 8546* (MO), *Hartman et al. 4689* (MO), *Hartman 8507, 8521, 8603* (MO), *Mori & Kallunki 5474* (K, MO, SEL); Cuasí-Cana Trail, *Kirkbride & Duke 1258, 1312* (MO); Pan-American Hwy., SE of Río Tuira, *Duke 14553* (US); Serranía de Pirre, above Cana gold mine, *Croat 37829* (MO, PMA, RSA, US); vicinity Rancho Frio, *Hartman 4461* (MO).

Anthurium testaceum Croat & Baker, Brenesia 16(Supl. 1): 92. 1979. TYPE: Costa Rica. Alajuela: Atlantic side of Alto de las Palomas, 1,900 m, *Lent 1820* (F, holotype).

Epiphytic or terrestrial; stems elongate, ca. 1 m long, 1–1.5 cm diam.; cataphylls drying greenish yellow to brown, weathering and often persisting, ultimately deciduous; petioles (8–)14–48



FIGURES 161–164. 161. *Anthurium tysonii* Croat, *Croat 35878.*—162. *Anthurium terryae* Standl. & L. O. Wms., *Croat 37829.*—163. *Anthurium terryae* Standl. & L. O. Wms., *Croat 28721.*—164. *Anthurium vallense* Croat, *Croat 37327.*

cm long, 3–6 mm diam., terete; blades oblong-lanceolate to lanceolate to oblong-elliptic, moderately thin, obtuse to rounded (rarely acute) at base, 18–50 cm long, 4–12.5 cm wide. Inflorescence spreading; peduncle 14–40 cm long, 3–5 mm diam., terete; spathe more or less thin, green lanceolate, 3–7 cm long, 7–14 mm wide; stipe 1–7 mm long; spadix green, sometimes tinged with violet purple, 4–12 cm long, 4–6 mm diam. at base; berries bright red, oblong-ellipsoid, rounded at apex, 10–13 mm long; seeds 2. See Croat (1983: 395) for a more complete description.

The species is found in Costa Rica and Panama from 800 to 2,000 m in premontane wet and premontane rain forest life zones. In Panama, the species is known only from western Panama near Costa Rica in the Provinces of Bocas del Toro and Chiriquí.

Anthurium testaceum is in section *Xialophyllium* and can be distinguished by its elongate narrow stem, its long, thin, persistent cataphylls, its bright red, prematurely exserted berries, its few-flowered spadix spirals, and by its lanceolate leaf with the midrib and primary lateral veins drying very pale tan.

BOCAS DEL TORO: ENE of Cerro Pata de Macho, *Hammel 6130* (MO).
CHIRIQUÍ: Finca Ojo de Agua, *Knapp 1586* (MO); Cerro Colorado, *Antonio 4902* (MO).

Anthurium tilaranense Standl., J. Wash. Acad. Sci. 17: 245. 1927. TYPE: Costa Rica. Guanacaste: Quebrada Serena, SE of Tilarán, 700 m, Jan. 1926, *Standley & Valerio 46310* (US, holotype).

Anthurium latihastatum Engl. ex K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 11: 612. 1932. SYNTYPES: Costa Rica. Near San Ramón, 1,300–1,400 m, May 1913, *Tonduz 17708* (not seen); 1,200 m, *Tonduz 17704* (not seen).

Epiphyte; stems to 1 m long; cataphylls drying reddish brown, persisting intact; petioles (8–)16–45 cm long, 4–6 mm diam.; blades subcoriaceous, 3-lobed, 20–46 cm long, 10–60 cm wide. Inflorescence more or less erect; peduncle (7–)10–25(–30) cm long; spathe subcoriaceous, pale green, broadly lanceolate to oblong or oblong-elliptic, 5.5–11 cm long, 1.7–3 cm wide; spadix pale green to white, 4.5–14 cm long, ca. 8 mm diam. midway; berries red (at least apically), obovoid, ca. 7 mm long, 5 mm wide, obtuse at apex; seeds 2. See Croat (1983: 396) for a more complete description.

The species is known in Costa Rica and Panama from 400 to 1,500 m in premontane wet, tropical wet, and lower montane forest.

Anthurium tilaranense is a member of section *Semaeophyllium* but is not closely related to any other species in the section. It is distinguished by its deeply three-lobed leaf blade with the lateral lobes falcate, its persistent cataphylls, and its pale green to white spadix that is slightly tapered at both ends. In Panama, it has leaves similar to *A. madisonianum,* which has a longer, reddish spadix and prominently weathering cataphylls.

CHIRIQUÍ: Cerro Colorado, *Croat 33365* (MO, PMA).
COCLÉ: La Mesa, *Croat 37354* (MO), *Wilbur et al. 15663* (DUKE).
DARIÉN: Cerro Pirre, *Gentry 4602* (DUKE, F).
PANAMÁ: Cerro Pelado, *Antonio 1086* (MO).
VERAGUAS: vicinity Santa Fe, *Mori & Kallunki 2589* (MO), *Nee 11226* (MO).

Anthurium tonduzii Engl., Bot. Jahrb. Syst. 25: 376. 1898. TYPE: Costa Rica. San José: near San Marcos, in forest near Alto de Pito, 1,400 m, *Tonduz 7683* (B, holotype).

Epiphyte or terrestrial, usually creeping, stems elongate; cataphylls early deciduous; petioles subterete, narrowly and obscurely sulcate, 1.5–12 cm long, 2–3 mm diam.; blades ovate to ovate-elliptic, moderately thick, obtuse to rounded or rarely subcordate at base, 6–13 cm long, 3.5–8.5 cm wide. Inflorescence erect-spreading; peduncle 3.5–14 cm long; spathe lanceolate, green tinged reddish, subcoriaceous, 1.5–3 cm long, 0.5–1 cm wide; spadix green to red, 2.5–3 cm long, 4–5 mm diam. midway (dry); berries white, turning purple at maturity, oblong, ca. 1 cm long; seeds 2. See Croat (1983: 400) for a more complete description.

Anthurium tonduzii occurs in Costa Rica and Panama at 800 to 1,500 m in premontane rain and lower montane rain forest. It has been collected on Cerro Pirre in Darién Province of Panama and is to be expected in Colombia in the Department of Chocó.

Anthurium tonduzii is a member of section *Tetraspermium* and can be recognized by its elongate stems with long internodes, its entire, deciduous cataphylls, its green to reddish spadix,

and by its purple berries that are white before maturity.

CHIRIQUÍ: vicinity Cerro Colorado, *Croat 33239* (MO), *Mori & Dressler 7898* (MO), *Sullivan 360* (MO).
COCLÉ: Alto Calvario, *Croat 49171* (MO), *Folsom & Jaslon 2695* (MO); El Copé, *Hammel 6284* (MO); El Potroso, *Sytsma 1801* (MO).
DARIÉN: Cerro Pirre, *Folsom 4301* (MO).
VERAGUAS: slopes of Cerro Tute, *Croat 48954* (MO); N of Santa Fe, *Hammel 4695* (MO).

Anthurium trinerve Miq., Linnaea 17: 67. 1843.
Anthurium scandens var. *trinerve* (Miq.) Matuda, Anales Inst. Biol. Univ. Nac. Mexico 25: 189. 1954. TYPE: Surinam. Palmar Awara, *Forbe 120* (U).

Anthurium brachyspathum C. Koch & Bouché in C. Koch, Allg. Gartenzeitung 25: 233. 1857. TYPE: Surinam?
Anthurium trinerve var. *obtusum* Engl., Bot. Jahrb. Syst. 25: 357–358. 1898. TYPE: Ecuador. Valle Pallatanga, *Sodiro 2* (not seen).
Anthurium trinerve var. *angustifolium* K. Krause, Bot. Jahrb. Syst. 54 (Beibl. 118): 123. 1916. TYPE: Bolivia. Antahuacana at Espíritu Santo: 750 m, *Buchtien* (not seen).
Anthurium codajasii G. M. Barroso, Arch. Jard. Bot. Río de Janeiro 15: 97. 1957. TYPE: Brazil. Amazonas: Codajás, Logos de Badajós, *Froes 26590* (not seen).

Epiphytic; stems elongate, creeping; internodes 1–3.5 cm long; cataphylls drying brown, weathering to longitudinal fibers and persisting around stem; petioles 1.3–6 cm long, 2.5–3.5 mm diam., more or less D-shaped, broadly and sharply sulcate; blades moderately thick, elliptic to ovate-elliptic to lanceolate, 8–17 cm long, 3–7.5 cm wide, obtuse to attenuate at base; lower surface conspicuously punctate. Inflorescence erect, peduncle 2–6.5 cm long; spathe thick, oblong-elliptic, greenish white, 2.5–3.5 cm long, 0.5–1.1(–1.9) cm wide, erect at anthesis; spadix dark lavender or green to white, 2–4 cm long, 5–7 mm diam. at base, 2–3 mm diam. at apex; berries white or sometimes pale lavender, globose, 5–7 mm diam. See Croat (1983: 400) for a more complete description.

The species is found in Guatemala and Belize to the Guianas and central Brazil at elevations of zero to 800 m, in tropical moist, premontane wet, and tropical wet forest life zones. In middle America, the species has been collected only on the Atlantic slope but it occurs on both slopes in Costa Rica and Panama.

Anthurium trinerve is easily confused with *A. scandens,* but generally occurs at lower elevations (to 800 m). Other differences are discussed under *A. scandens.* It is a member of section *Tetraspermium.*

BOCAS DEL TORO: vicinity Almirante, *Croat 38195* (MO, PMA), *D'Arcy 11189* (MO), *McDaniel 5113* (MO); vicinity Chiriquí Lagoon, *Wedel 1149, 1290, 2040, 2171, 2390* (MO); Isla Colón, *Wedel 566, 2799* (MO); Water Valley, *Wedel 735* (MO); Westom River, *Wedel 20* (MO); junction of Changuinola & Terebe Rivers, *Lazor et al. 2473* (MO).
CANAL ZONE: mouth of Río Chagres, *Allen 884* (MO); Barro Colorado Island, *Croat 14969* (MO), *Foster 911, 1229* (DUKE).
CHIRIQUÍ: between Progreso & Puerto Armuelles, *Croat 21881* (MO, NY); San Bartolo Limite, W of Puerto Armuelles, *Croat 22178* (MO); Sioquí Arriba, *Hertentains 44* (MO).
COCLÉ: Boca de Toabre, at confluence of Río Toabre & Río Coclé del Norte, *Lewis 5919* (MO); N of El Copé, *Folsom 2878* (MO).
COLÓN: road from Colón to Portobelo, *Folsom 3762* (MO); SW of Portobelo, *Croat 14122* (MO); upstream on tributary of Río Boquerón, *Kennedy 2654* (MO, US); Río Guanche, *Foster 2341* (DUKE); ridge between Río Piedras & Río Gatún, *Sytsma et al. 4299* (MO); along Santa Rita Ridge, *Webster & Dressler 16733* (DAV).
DARIÉN: downstream from El Real, *Duke 4940* (MO); Manané to mouth of Río Cuasí, *Kirkbride & Bristan 1455* (MO, NY).
HERRERA: W of Las Minas, *Hammel 4234* (MO).
PANAMÁ: Cerro Campana, *Luteyn 3183* (DUKE); Cerro Jefe, *Sheffer 218, 220* (MO); El Llano-Cartí Road, *Croat 22884, 25105* (MO), *Kennedy et al. 2410* (MO), *Kennedy 3397* (US), *Liesner 668* (MO), *Madison 5504* (MO), *Sytsma 4139* (MO); Río Majé, *Croat 34391A* (MO); Río Pacora, below confluence with Río Corso, *Duke 12044* (MO); from Tortí to Pilota del Toro, *Folsom et al. 5114* (MO).
SAN BLAS: El Llano-Carti Road, *Knapp 1826* (MO).
VERAGUAS: vicinity Santa Fe, *Folsom 1583* (MO), *Mori & Kallunki 2557* (MO).

Anthurium trisectum Sodiro, Anales Univ. Centr. Ecuador 20: 100. 1905. TYPE: Ecuador. Esmeraldas: en la orilla del Río San Antonio, *Sodiro 8/904* (B, holotype).

Usually terrestrial, sometimes epiphytic, creeping; stems elongate; cataphylls weathering to fine longitudinal fibers, ultimately deciduous; petioles 18–36(–40) cm long, weakly sulcate; blades 3-parted; moderately thin, leaflets sessile or on petiolules to 2 cm long; median leaflet more or less elliptic to ovate, 12–25 cm long, 4–11 cm wide, obtuse at base. Inflorescence erect; peduncle 9–22 cm long, terete; spathe lanceolate or

ovate, green becoming white or yellow, 4–6 cm long, 1.2–2.5 cm wide, rounded at base; spadix green to yellow, 3.7–5 cm long, 4–6 mm diam. at base; berries violet purple, globose to ovoid, with a short beak. See Croat (1983: 401) for a more complete description.

The species occurs from Costa Rica to Ecuador at elevations from sea level to 500 m in tropical wet forest life zones. In Panama, the species is known only from 300 to 500 m north of Santa Fe in Veraguas, principally on the Atlantic slope.

Anthurium trisectum is a member of section *Dactylophyllium* and is distinguished by its usually terrestrial habit and thin, three-parted leaf blades with conspicuously impressed veins.

CHIRIQUÍ: along road to Fortuna Dam site, *Croat 49077* (MO).

COCLÉ: N of Alto Calvario, *Folsom 5842* (MO); NW of El Copé, *Hammel 3322* (MO); Llano Grande to Coclecito Road, *Croat 49227* (B, CAS, K, M, MO, NY, RSA, S, VEN, W), *Hammel 1794, 1826* (MO); N of Penonomé, *Hammel 1679* (MO); between Río Blanco & Río Sucio, *Sytsma et al. 2496* (MO, PMA).

VERAGUAS: Cerro Tute, *Antonio 4028* (MO); 11 km from Escuela Agricola Alto Piedra, *Mori & Kallunki 3095* (MO); vicinity Santa Fe, *Folsom 3038* (MO), *Mori & Kallunki 6099, 6192* (MO); Río Calabacito, *Maas & Dressler 1626* (MO); headwaters of Río Calovebo-rita, *Sytsma & Andersson 4765* (MO); valley of Río Dos Bocas, *Croat 27362* (MO, PMA); along road from Santa Fe to Calovébora, *Croat 48977* (MO), *Mori et al. 6700* (MO); beyond Tres Brazos River, *Croat 25633* (MO).

Anthurium tutense Croat, sp. nov. TYPE: Panama. Veraguas: slopes of Cerro Tute, near Escuela Agricola Alto Piedra NW of Santa Fe, 8°33′N, 81°8′W, 1,350 m, *Croat 48951* (MO 2727102, holotype; K, NY, PMA, US, VEN, isotypes; Live at MO).

Planta epiphytica; cataphyllum membranaceum, findens fibris longitudinalis; petiolus argute et profunde sulcatus, glanduloso-punctatus, 3.5–19 cm longus; lamina subcoriacea, elliptica ad lanceolata, (4–)7.2–14 cm longa, (1.3–)2.5–8.5 cm lata; utrinque glanduloso-punctata; inflorescentia erecta; pendunculus 11.2–26 cm longus, interdum suffusus rubescens, spatha membranacea, viridis, suffusa rubescens, anguste ovata, 2–5.2 cm longa, 0.9–16 cm lata; spadix atromarroninus, 1–4.2 cm longus; baccae rubrae, depresso-globosae, 4–5 mm longae.

Epiphyte; stems 10-20 cm long, 5–10 mm diam.; roots thin, descending; leaf scars hidden by cataphylls; cataphylls thin, 1–3 cm long, drying tan, weathering into longitudinal fibers. LEAVES erect-spreading; petioles 3.5–19 cm long, 1–2.5 cm diam., sharply and deeply sulcate (the sulcus rounded to flattened with an obscure medial rib near apex), round, dark glands scattered on surface; geniculum 2–15 mm long; blades subcoriaceous, elliptic to lanceolate, sometimes arched along midrib and downturned at apex, long acuminate, obtuse at base, (4–)7–14 cm long, (1.3–)2.5–8.5 cm wide, broadest at middle or in lower one-fourth of blade; semiglossy on both surfaces, the upper surface with depressed, black glands, the lower surface with reddish brown glands; midrib sharply raised at base above, flat toward middle, sunken at apex, raised below; primary lateral veins (3–)4–7 per side, departing midrib at 40–45° angle, etched into surface above, prominulous below; collective vein arising from base, etched into surface above, raised below, secondary collective vein arising from the base, usually running out to margin near middle or below. INFLORESCENCE erect-spreading; peduncle 11.2–26 cm long, ca. 2 mm diam., sometimes tinged red-violet, equalling or twice as long as petioles; spathe thin, green, tinged red-violet, narrowly ovate, 2–5.2 cm long, 0.9–1.6 cm wide, broadest near middle or just below, inserted at 65° angle on peduncle, becoming reflexed with the margins turned up; stipe 3–17 mm long; spadix deep maroon (B & K Red-purple 2/10–3/10), 1–4.2 cm long, 4–6 mm diam. near base, 2–3 mm diam. near apex; flowers weakly 4-lobed, 2.5–4 mm long, 2.7–3.2 mm wide, the sides straight parallel to spirals, sigmoid perpendicular to spirals, 3–4 flowers visible in the principal spiral, 5–6 flowers visible in the alternate spiral; tepals matte, densely papillate, lateral tepals 1.5–1.7 mm wide, the inner margins straight to convex; pistils emergent, glossy, green, sometimes tinged reddish; stigmas linear, 0.6–0.7 mm long; stamens emerging in a prompt, complete sequence from the base, laterals first, exserted fully above edge of tepals, promptly retracting below edge of tepals, the laterals usually fully retracted before alternates emerge; anthers white, ca. 0.5 mm long, ca. 0.7 mm wide, held flat over edge of pistil before retracting; thecae ovate, not divaricate; pollen white. INFRUCTESCENCE with spadix ca. 4 cm long, 1 cm diam. (to 2.3 cm with berries exserted); berries orange to red, depressed-globose to obovoid, depressed and darker reddish at apex, 4–5 mm long, 5–6 mm diam.; mesocarp fleshy, gelatinous; seeds 2–3(–4), tan, 2–2.2 mm long, 1.5–1.7 mm wide, 1 mm thick. Figs. 147 and 148.

Anthurium tutense is endemic to central Panama in the Provinces of Chiriquí, Coclé, and Veraguas at 800 to 1,350 m in premontane and lower montane rain forest life zones. Most collections thus far have been made on Cerro Tute (thus the name) above Santa Fe or along the Continental Divide above El Copé; one collection was recently made in Chiriquí.

This species is one of the smallest Anthuriums and is a member of section *Porphyrochitonium.* It is characterized by its small lanceolate to ovate, gracefully long-acuminate leaf blades that are glandular-punctate on both surfaces and are often arched along the midrib in live plants. Also characteristic are the minutely etched veins and a dense scattering of minute but clearly visible, sunken veins on the upper surface (not obviously sunken on dried material). The stem has short internodes with persistent cataphylls. Also characteristic are the maroon spadix and orange to red berries.

The species is similar to *Anthurium jefense* in size and general appearance of the leaves, but that species has leaves that are much less acuminate and has the veins weakly raised on dried specimens whereas *A. tutense* has the veins weakly sunken.

CHIRIQUÍ: Fortuna Dam Road, 10 km from Los Planes de Hornito, *Knapp 5007* (MO).

COCLÉ: Alto Calvario, *Folsom & Jaslon 2681* (MO); N of El Copé, *Folsom et al. 5683, 5695* (MO), *Hammel 3566* (MO), *6285* (MO, PMA).

VERAGUAS: Cerro Arizona, *Hammel 4697* (MO); Cerro Tute, *Antonio 3469* (MO), *Croat 48951* (K, MO, NY, PMA, US, VEN), *Folsom & Mauseth 8345, 8356* (MO), *Mori 6261, 6285, 6744, 6745* (MO), *Witherspoon et al. 8885* (MO).

Anthurium tysonii Croat, sp. nov. TYPE: Panama. Panamá: at summit of Cerro Jefe, ca. 1,000 m, 15.4 mi. above Pan-American Hwy., 9°12′N, 79°22′W, *Croat 49090* (MO 2737327, holotype; CAS, CR, F, K, NY, PMA, US, VEN, isotypes; Live at MO).

Planta plerumque terrestris; cataphyllum coriaceum persistens intactum; petiolus anguste et acute sulcatus adaxiale, multicostatus abaxiale, 26–58 cm longus; lamina modice coriacea, ovata, basi profunde cordata, (16–)28–48 cm longa, (11–)22–36 cm lata; inflorescentia erecta; pedunculus 10–24 cm longus; spatha subcoriacea, pallide viridis, ovata ad late lanceolata, 6–10 cm longa, 2–4.5 cm lata; spadix pallide viridis ad cremeus, purpurescens per anthesin, (4.5–)6–10 cm longus; baccae immaturae albae ad pallide purpureae.

Usually terrestrial; stems 10 cm or more long, ca. 2 cm diam., leaf scars ca. 1 cm wide, mostly obscured by cataphylls; roots moderately thick, green, descending; cataphylls subcoriaceous, 15–24 cm long, acute at apex with minute subapical apiculum, drying brown (B & K Yellow 4/5–4/7.5), persisting intact. LEAVES with petioles erect-spreading, 26–58 cm long, 5–7 mm diam., narrowly sulcate, the margins acute, sometimes several ribbed abaxially; geniculum 2–3 cm long; blades moderately thick, ovate, acuminate at apex, deeply lobed at base, (16–)28–49 cm long, (11–)22–36 cm wide, broadest at point of petiole attachment or just above; anterior lobe (15–)23–34 cm long, the margins rounded, posterior lobes (4.2–)9–13 cm long, from apex of sinus to outermost point; sinus triangular to hippocrepiform, usually acute at apex; upper surface semiglossy with conspicuous round raphide cells; lower surface glossy; midrib acutely raised from base to middle, flat to weakly sunken toward apex above, acutely raised below; basal veins (3–)5–6 pairs, free to the base, sunken above, raised below, posterior rib absent; primary lateral veins 3–6 per side, departing midrib at 40–45° angle, sunken above, raised below, more or less straight to collective vein; interprimary veins weakly sunken above, obscure below; collective vein arising from the first or second basal vein, 3–5 mm from margin, sunken above, raised below. INFLORESCENCE erect, shorter than leaves; peduncle 10–24 cm long, 4–6 mm diam., one-half to one-third as long as petiole; spathe subcoriaceous, pale green, ovate to broadly lanceolate, 6–10 cm long, 2–4.5 cm wide, broadest near the base, long-acuminate to cuspidate at apex, rounded, more or less clasping at base; spadix pale green to creamy white, turning violet purple at anthesis, scarcely tapered at apex, (4.5–)6–10 cm long, 8–10 mm diam. near base, 6–8 mm diam. near apex; flowers rhombic, 1.7–1.9 mm long, 1.8–2.1 mm wide, the sides sigmoid, 6–9 flowers visible in the principal spiral, 11–15 flowers visible in the alternate spiral; lateral tepals ca. 1.1 mm wide, the inner margin convex; pistils scarcely emergent; stigmas linear; stamens emerging in a scattered manner, laterals usually emerging throughout before alternates emerge; anthers held at edge of tepals; thecae ovate. INFRUCTESCENCE erect; spathe usually reflexed; spadix 8–10 cm long, 2–2.3 cm diam.; immature berries rounded at apex, white to pale purple. Figs. 161 and 165.

Anthurium tysonii is endemic to Panama and

is known only from the vicinity of Cerro Jefe at 600 to 1,000 m in tropical wet forest.

A member of section *Calomystrium,* it is distinguished by its terrestrial habit, its many-ribbed petioles, its broadly ovate, cordate blades with free basal veins, and by its short pedunculate inflorescence with a white spadix that becomes violet purple in age.

The species is confused with no other species in the genus and is the only member of section *Calomystrium* in North America with free ending basal veins. The usually many-ribbed petiole and the short pedunculate inflorescence make the species unique.

It is named for Dr. Edwin L. Tyson who made some of the earliest collections of the species.

PANAMÁ: Altos de Pacora, *Lewis et al. 2282* (MO), *Mori & Kallunki 2345* (MO); Campo Tres, *Croat 22691A* (F, MO), *27090* (MO, US); N of Cerro Azul on road to Cerro Jefe, *Blum et al. 1798* (SCZ); Cerro Azul, *Mori & Kallunki 2207* (MO); Cerro Jefe, *Antonio 2490* (MO), *Busey 784* (F, MO), *Croat 35878* (MO), *49090* (CAS, CR, F, K, MO, NY, PMA, US, VEN), *Duke 8155* (OS, US), *Dwyer & Gentry 10269A* (DUKE, MO), *Folsom et al. 1840* (MO), *Folsom & Kearns 2720* (MO), *Gentry et al. 3457* (AAU), *3500* (DUKE, F, MO), *Hammel 3737* (MO), *Kennedy et al. 3364* (F, U, US), *Luteyn & Kennedy 3973* (DUKE), *Sullivan 190* (MO), *Tyson 3528* (MO), *Tyson et al. 4387* (MO, SCZ), *4389* (SCZ), *Witherspoon & Witherspoon 8532, 8556* (MO).

Anthurium validifolium K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 11: 607. 1932. TYPE: Panama. Chiriquí: forests along Río Ladrillo, above El Boquete, 1,200–1,300 m, *Pittier 3052* (US).

Epiphytic; stems to 16 cm long, 12 cm diam.; cataphylls drying tan, persisting more or less intact; petioles 20–27 cm long, 7–10 mm wide, more or less quadrangular, broadly and shallowly sulcate; blades lanceolate, coriaceous, 47–69 cm long, 10–19 cm wide, rounded at base. Inflorescence spreading; peduncle 33–39 cm long, 9–12 cm diam., subterete; spathe coriaceous, dark green, turning yellow, ovate-lanceolate, 16–17 cm long, ca. 4 cm wide; spadix lavender to purple, green at apex in early stages, 15–23 cm long, 1.2–3.5 cm diam. at base; berries bright orange, obovoid, flattened at apex, 8–15 mm long; seeds 1–2. See Croat (1983: 407) for a more complete description.

Anthurium validifolium is known for certain only from Chiriquí Province in Panama. Most collections have been made in lower montane wet and lower montane rain forest from 1,600 to 2,000 m.

The species, a member of section *Pachyneurium,* is characterized by its large, moderately thick, lanceolate leaf blade, its lavender to purple spadix, and by its bright orange, obovoid berries.

CHIRIQUÍ: between Bambito & Cerro Punta, *Croat 10553* (MO), *10554* (F, MO); NW side of Cerro Pando, *Croat 15971* (MO, NY); Cerro Pelota, *Knapp 1497* (K, MO), *1513* (F, MO), *1522, 1523, 1526, 1528, 1529* (MO); vicinity Boquete, *Davidse & D'Arcy 10309* (MO), *Pittier 3052* (MO, US); N of El Hato del Volcán, *Croat 10667* (B, F, GH, K, MO, NY, PMA, RSA, US).

Anthurium vallense Croat, Selbyana 5: 338. 1981. TYPE: Panama. Coclé: La Mesa, above El Valle de Antón, ca. 2 km W of Cerro Pilón on slopes of steep hill, 860–900 m, disturbed virgin forest, *Croat 37327* (MO 2395387, holotype; B, CAS, F, K, NY, PMA, SEL, US, W, isotypes; Live at MO).

Creeping epiphyte or terrestrial; stems elongate, to 60 cm long or more, ca. 1.5 cm diam.; internodes to 1.5 cm long, shorter near apex; leaf scars ca. 1 cm wide; roots long, thin, moderately dense; cataphylls 12–14 cm long, green, acute and apiculate at apex, drying tan, weathering to reticulate fibers and persisting. LEAVES spreading; petioles 7–19 cm long, 1–1.5 cm wide, triangular, sharply sulcate, sharply 1-ribbed abaxially; geniculum 1–3 cm long, shaped like petiole; blades elliptic to oblanceolate-elliptic, coriaceous, abruptly short to long acuminate at apex (the acumen minutely apiculate), acute to obtuse at base, 17–40 cm long, 5–16 cm wide, broadest near middle or above; both surfaces glossy, the upper surface minutely glandular-punctate; lower surface minutely and more or less densely glandular-punctate; midrib raised above, narrowly acute, diminishing toward apex, sharply and acutely raised below; primary lateral veins 14–18 per side, departing midrib at ca. 45° angle, sunken above, raised below, almost straight to the collective vein; interprimary veins sunken above, raised below; collective vein arising from the base, 5–8 mm from the margin, sunken above, raised below. INFLORESCENCE erect-spreading, longer than the leaves; peduncle 25–49 cm long, 5–7 mm diam., conspicuously 1–4-ribbed, 3–7 times longer than petioles; spathe subcoriaceous, pale green, oblong or oblong-lanceolate, 11–15 cm long, 1.5–2.7 cm wide, broadest near

or above the middle, abruptly acuminate at apex, obtuse at base, inserted at ca. 70° angle on peduncle; spadix green to yellow, turning reddish, 5–18 cm long, 3–10 mm diam. at base, 2–6 mm diam. at apex, held at 180° angle from peduncle; flowers rhombic, 2.5–3.5 mm long, 1.5–3.5 mm wide, the sides straight to slightly sigmoid, 3–5 flowers visible in the principal spiral, 7–9 flowers visible in alternate spiral; lateral tepals 1–1.5 mm wide, the inner margin straight to convex; pistil slightly raised at anthesis; stigma ca. 0.8 mm long, oblong, brush-like, exserted; anthers (dry) ca. 3 mm long, 5 mm wide; thecae ellipsoid, scarcely divaricate. INFRUCTESCENCE spreading-pendent; spathe reflexed, sometimes absent; spadix 11–45 cm long, 1–1.5 cm diam.; berries red, oblong-elliptic, moderately acute toward apex, 6–10 mm long, prominently exserted. Figs. 164 and 166.

Anthurium vallense ranges from Panama to Colombia, though it is interesting to note that in Panama, it has been collected only west of the isthmus where it occurs in premontane wet, tropical wet, and premontane rain forest at elevations of 350 to 1,200 m. In Colombia, the species may occur almost at sea level.

Anthurium vallense is in section *Porphyrochitonium* and is characterized by elliptic to oblanceolate-elliptic, glandular-punctate leaves that dry yellowish green and especially by the conspicuous network of weathered, fibrous cataphylls that persist. It is not easily confused with any other species.

COCLÉ: Alto Calvario, *Croat 48157* (MO), *Folsom 2342A, 3241, 3413* (MO), *Folsom & Robinson 2405* (MO), *Folsom & Collins 6521* (MO), *Folsom et al. 8254* (MO); Cerro Caracoral, *Kirkbride 1114* (MO), *Knapp 1128* (MO), *1155* (K, M, MO, RSA), *Sytsma 3753* (MO); Cerro Pilón, *Duke & Correa 14698* (US), *Porter et al. 4426* (MO); Continental Divide ridge, Coclecito Road, *Hammel 2542* (MO); vicinity El Copé, *Antonio 1179A* (MO), *Croat 44751* (MO), *Folsom 1215, 4946, 4947* (MO), *Folsom & Lantz 1874* (MO), *Folsom et al. 5691* (MO), *Hammel 781, 996, 1024, 2360, 2399, 2400, 2637, 2638, 3523, 3524, 4111, 4145* (MO), *3556* (B, M, MO, PMA, VEN); 5 hour walk from sawmill at El Copé, *Antonio 3631* (MO); above El Potroso, *Sytsma 1843* (MO); El Valle de Antón, *Allen 2731* (F, MO), *Croat 14289* (MO), *Folsom 3118* (MO), *Luteyn 1148* (DUKE, MO), *1152* (DUKE), *Luteyn & Kennedy 1620* (DUKE, MO), *Kennedy & Dressler 1756* (MO), *Woodson & Schery 198* (MO); La Mesa, *Croat 13426* (MO), *25409* (MO, PMA), *14376* (F, MO), *37327* (B, CAS, F, K, MO, NY, PMA, SEL, US, W), *Dwyer 11883* (AAU, MO), *11910* (AAU, GH, MO), *Folsom & Butcher 2794, 2839A, 2839B* (MO), *Folsom 3641* (MO), *Folsom & Raul 5643* (MO), *Gentry 5657, 7444* (MO), *Kennedy et al. 3044* (MO), *Nee & Dwyer 9143* (MO), *Nee & Hale 9628* (MO), *Sullivan 479* (MO), *Sytsma et al. 4368* (K, MO), *Wilbur et al. 15659, 15668* (DUKE); along Road from La Pintada to El Copé, *Hammel 2624* (MO); N of Llano Grande on road to Coclecito, *Hammel 1949* (MO); past Llano Grande on road to Cascajal, *Sytsma 3908, 3966* (MO); Quebrada Amarillo in La Mesa, *Sytsma & D'Arcy 3572* (MO).

COLÓN: Río Guanche, *Kennedy & Mori 3458* (F).

PANAMÁ: trail to top of Cerro Pelado, *Antonio 1102* (MO).

VERAGUAS: slopes of Cerro Tute, *Croat 48948* (MO), *Witherspoon et al. 8874* (MO); valley of Río Dos Bocas, *Croat 27363, 27476, 27566* (MO); vicinity Santa Fe, *Antonio 4953* (MO), *Croat 23009, 27661, 49030* (MO), *23022* (F, MO), *D'Arcy 10307* (MO), *Liesner 1024* (MO), *Mori et al. 3829, 3888, 3948* (MO), *Mori & Kallunki 6122* (MO), *Mori 6658, 6721* (MO), *Mori & Bolten 7613, 7666* (MO).

Anthurium watermaliense Hort. ex L. H. Bailey, Stand. Cycl. Hort. 1: 303. 1927. TYPE: Colombia. Not seen (introduced into horticulture via Watermall, Belgium).

Terrestrial; stems to 25 cm long, cataphylls weathering into coarse fibers; petioles 12–88 cm long, more or less terete, weakly flattened or sulcate; blades ovate-triangular, moderately thick, deeply lobed at base, 30–60 cm long, 19–36 cm wide. Inflorescence spreading; peduncle 12–66 cm long, 5–7 mm diam.; spathe lanceolate-triangular, green to dark violet purple, subcoriaceous, 5–21 cm long, 2.3–8.5 cm wide; stipe very short or to 2 cm long; spadix white to greenish, yellow or purple, 7–10 cm long; berries yellow to orange, ovoid to obovoid, beaked, 1–1.5 cm long. See Croat (1983: 411) for a more complete description.

The species is known from Costa Rica to Colombia, usually from 750 to 2,400 m in premontane rain and lower montane rain forest. Some populations also occur near sea level in tropical moist and premontane wet forest. The species is extremely variable, especially in leaf size and shape, and spathe and spadix color. It is strange that the species has not been found in tropical wet forest or at elevations between 100 to 700 m. Perhaps further study will show that the lower elevation populations represent a distinct species.

Anthurium watermaliense, a member of section *Belolonchium,* can be recognized by its ovate-triangular to sub-three-lobed leaf blades, its broad, frequently dark purple spathe, its green

to purple spadix with long-exserted stamens, and by its yellow to orange berries. It is not generally confused with any other species in Central America.

BOCAS DEL TORO: Railroad Station at Milla 7.5, *Croat & Porter 16246* (MO), *Croat 38129* (CAS, F, MEXU, MO, NY, PMA, S, SEL, UC, US).

CHIRIQUÍ: Cerro Colorado, *Croat 33265* (F, MO, US, VEN), *Folsom & Collins 1754, 1764* (MO), *Folsom et al. 4840* (MO), *Mori & Dressler 7849, 7852* (MO), *Sullivan 359* (MO); road from Gualaca to Fortuna Dam site, *Croat 49898* (MO); Palo Alto, NE of Boquete, *Hammel 7542* (MO); between Quebrada Hondo & Continental Divide on Calderas-Chiriquicito Trail, *Kirkbride & Duke 784, 960* (MO).

VERAGUAS: Escuela Agricola Alto Piedra on road to Río Calovébora, *Croat & Folsom 33958* (MO); along Santa Fe to Calovébora Road, *Croat 49035* (MO); vicinity Santa Fe, *Folsom 2994* (MO), *Mori & Kallunki 2563* (MO), *Nee 9717* (MO).

Anthurium wedelianum Croat, sp. nov.

a. Anthurium wedelianum ssp. **wedelianum.** TYPE: Panama. Bocas del Toro: Punta Peña, vicinity of Chiriquicito, ca. 330 m, *Lewis et al. 2150* (MO 1902384, holotype; GH, isotype).

Planta epiphytica; cataphyllum modice membranaceum persistens in fibris pallidis tenuibus; petiolus subteres, sulcatus, 4–9 cm longus; lamina modice membranacea, oblanceolata, basi acuta aut obtusa, 27–30 cm longa, 7–7.5 cm lata; inflorescentia foliis breviora; pedunculus teres, 7–9 cm longus; spatha oblongo-lanceolata, 3.5–5 cm longa; spadix stipite 1.3–1.5 cm longo, luteus, 8–8.5 cm longus; baccae ovoideo-ellipsoideae, 5.5–6 mm longae.

Epiphyte; stems less than 10 cm long, 0.5–1 cm diam.; the internodes short; roots few to moderately numerous in the lower portion of the stem; cataphylls moderately thin, 4–5 cm long, narrowly acuminate at the apex, weathering to thin, pale fibers that persist at the upper nodes. LEAVES spreading; petioles subterete, sulcate adaxially, 4–9 cm long, one-third to one-sixth as long as blade; blades moderately thin, oblanceolate, narrowly acuminate at apex, acute to obtuse at base, 27–30 cm long, 7–7.5 cm wide, broadest well above the middle; drying yellowish green, both surfaces semiglossy; midrib weakly raised above, prominently raised below; primary lateral veins 7–9 per side, departing the midrib at 35–40° angle, straight or weakly curved to the collective vein, scarcely or not at all raised above, prominulous below; interprimary veins present, usually much less conspicuous than the primary laterals; tertiary veins prominulous; collective vein arising from the base or near the base; basalmost lateral vein usually joining the margin very near the base. INFLORESCENCE much shorter than the leaves; peduncle terete, 7–9 cm long, shorter to longer than the petioles; spathe oblong-lanceolate, 3.5–5 cm long, acuminate at apex, narrowly acute at the base; inserted at a 25° angle on peduncle; stipe 1.3–1.5 cm long, 1–2 mm diam. (dry); spadix green to yellow, scarcely tapered to apex, 8–8.5 cm long, ca. 4 mm diam. at base, 3 mm diam. at apex; flowers rhombic, 3.2–3.8 mm long, 2.8–3 mm wide, the sides sigmoid, 2–3 flowers visible in the principal spiral; tepals semiglossy with conspicuous raphide cells visible, lateral tepals 2–2.2 mm wide, the inner margin thin, broadly rounded to obtusely angular; pistils not emergent but tepals turned up weakly on drying; stamens not studied. INFRUCTESCENCE to ca. 17 cm long, 1.3 cm diam.; berries ovoid-ellipsoid, 5.5–6 mm long, 4.5–5 mm diam., rounded on both ends; mesocarp with numerous, short raphide cells; seeds 2, about as broad as long, much flattened with a gelatinous appendage at one end. Fig. 169.

Anthurium wedelianum ssp. *wedelianum* is endemic to Panama and is known only from Bocas del Toro Province at sea level to approximately 300 m in a premontane wet forest life zone.

The species, tentatively placed in section *Urospadix,* is distinguished by its thin, oblong-oblanceolate, epunctate, green-drying leaf blades with prominent collective veins arising from the base. Also characteristic are its persistent, slender, pale cataphyll fibers and its slender green to yellow, prominently stipitate spadix.

The species is closest to *Anthurium platyrhizum,* which differs in having flattened, ribbon-like (versus terete) roots and a shorter, thicker, scarcely tapered spadix with the flowers prominently raised and separated from one another by sunken lines. Subspecies *wedelianum* is distinguished from ssp. *viridispadix* by its lower elevational range (to 300 m versus 500 to 800 m), its different life zone (premontane wet versus tropical wet and premontane rain forest), and by its yellow spadix with distinct linear raphide cells visible in the tepals. Subspecies *viridispadix* differs in having a dark green spadix and flowers that show no evidence of linear raphide cells.

Specimens now called *Anthurium wedelianum* were once called *A. michelii* and look superficially like the type of that species. The type of

FIGURES 165–168. 165. *Anthurium tysonii* Croat, *Croat 27090.*—166. *Anthurium vallense* Croat, *Croat 49157.*—167, 168. *Anthurium wedelianum* ssp. *viridispadix* Croat, *Croat 44640.*

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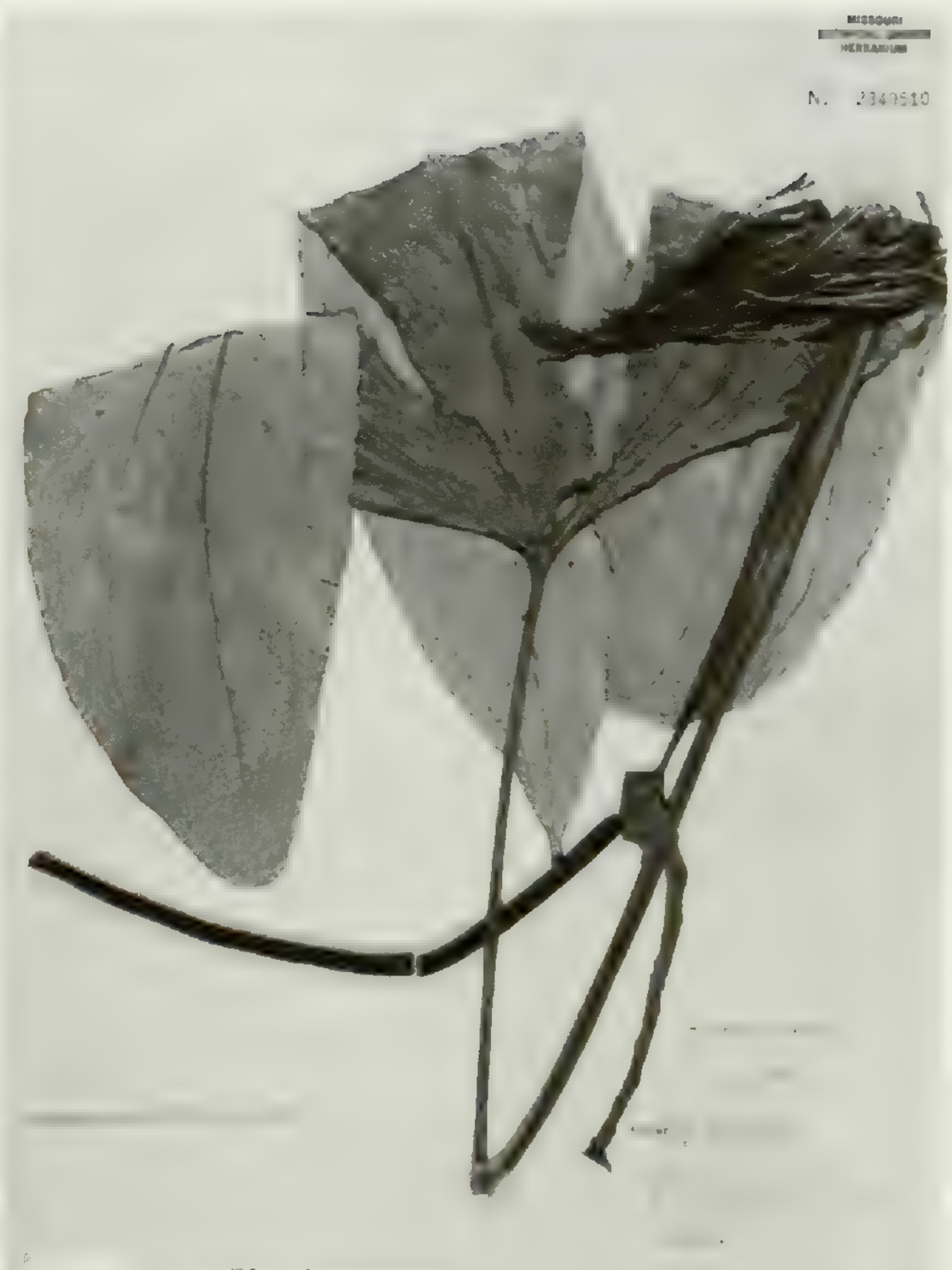

170 A. cineraceum Croat

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FIGURES 169–172. 169. *Anthurium wedelianum* ssp. *wedelianum* Croat, *Lewis et al. 2150.*—170. *Anthurium cineraceum* Croat, *Mori & Kallunki 5385.*—171, 172. *Anthurium teribense* Croat, *Kirkbride & Duke 529.*

A. michelii is an aberrant, unusually small specimen for the species (see discussion following *A. michelii*).

It is named in honor of its first collector, H. von Wedel, who collected actively in Bocas del Toro province in the late 1940s.

BOCAS DEL TORO: vicinity Chiriquí Lagoon, hills beyond Fish Creek, *Wedel 2276* (MO), *2371* (F); Punta Peña, vicinity Chiriquicito, *Lewis et al. 2150* (GH, MO).

b. Anthurium wedelianum ssp. **viridispadix** Croat, ssp. nov. TYPE: Panama. Coclé: on Atlantic slope near the Continental Divide along lumbering road N of El Copé, 9.4 km above El Copé (2.2 km N of sawmill), 8°42′N, 80°37′W, 750–900 m, *Croat 44640* (MO 2509620, holotype; K, PMA, US, isotypes; Live at MO).

Anthurium wedelianum ssp. *viridispadix* differt spadice atrovirentibus crescens altitudibus celsibus.

Epiphyte; stems less than 10 cm long, ca. 1 cm diam.; internodes short; leaf scars moderately conspicuous, 7–8 mm wide; roots green, moderately few, short, 2.3 mm diam.; cataphylls moderately thin, green, acuminate at apex, soon weathering to thin, pale fibers (at least at the base). LEAVES spreading; petioles 2–8 cm long, subterete, sharply to bluntly sulcate, sometimes with a faint medial rib, one-eighth to one-fourth as long as the blades; geniculum ca. 1.5 cm long, usually more sharply sulcate than the petiole; blades moderately thin, oblong-oblanceolate, gradually acuminate and sharply downturned at apex, acute at base, 21–35 cm long, 4.5–5.5 cm wide, broadest well above the middle; both surfaces semiglossy, epunctate, lower surface only slightly paler; midrib weakly raised in a moderately deep valley above, acutely raised below; primary lateral veins 4–7 per side, departing the midrib at 30–45° angle, straight to weakly curved to the collective vein, raised below, drying weakly raised above; tertiary veins prominulous beneath; collective vein usually arising from the base, rarely from one of the lower primary lateral veins. INFLORESCENCE shorter than leaves; peduncle subterete with several weak, purplish ribs, sometimes spotted with purple, 8–10(–25) cm long, ca. 3 mm diam., longer than the petioles; spathe moderately thin, green, ovate-lanceolate to oblong-lanceolate, acuminate at apex, rounded at base, 4–6 cm long, 0.7–1.7 cm wide, broadest below the middle, inserted at a 20° angle on peduncle; stipe 9–10 mm long (to 2.5 cm in fruit), 2–3 mm diam., green tinged with purple at base; spadix dark green, moderately tapered to the apex, (4–)5.5–11 cm long, 6 mm diam. near the base, 3 mm diam. near the apex; flowers rhombic, 5–5.5 mm long, 3.7–4.5 mm wide, the sides jaggedly sigmoid; 2–3 flowers visible in the principal spiral; tepals glossy, the lateral tepals 5–6-sided, 3–3.5 mm wide, broadly rounded to obtusely angular on the inner margin; pistil not usually apparent before anthesis of stamens, eventually weakly emergent, paler green than the tepals with purplish dots; stigma broadly ovate; stamens emerging promptly from the base, the lateral pair often extending ca. three-fourths the length of the spadix before the alternates emerge, the alternates emerging in a prompt sequence, persisting in a tight, contiguous cluster just above the edge of the tepals; anthers white, 0.3–0.4 mm long, 0.5 mm wide; thecae ovoid, slightly divaricate; pollen orange fading to tan. INFRUCTESCENCE to ca. 14 cm long; berries subglobose, dark violet purple, ca. 7 mm long; mesocarp densely imbedded with short raphide cells; seeds 2, ca. 4 mm long, 2.8 mm diam., 1.5 mm thick. Figs. 167 and 168.

Anthurium wedelianum ssp. *viridispadix* is endemic to Panama on the Atlantic slope and known only from Veraguas, Coclé, and Colón Provinces at 500 to 800 m in tropical wet and premontane rain forest life zones.

This subspecies is distinguished from the typical subspecies by having a green spadix (thus the name *viridispadix*) that lacks raphide cells in the tepals. In addition, the latter is known from below 300 m elevation in premontane wet forest.

COCLÉ: Continental Divide on road to Coclecito, *Hammel 3499* (MO); N of El Copé, *Croat 44640* (K, MO, PMA, US); N of Llano Grande on road to Coclecito, *Hammel 1935* (MO, PMA); new works at Rivera sawmill, Alto Calvario, *Folsom 3179* (MO).

COLÓN: between Río Piedras & Río Gatún, SW of Cerro Bruja, *Sytsma et al. 4308* (MO, PMA).

VERAGUAS: NW of Santa Fe, *Mori & Kallunki 6182* (MO).

Anthurium wendlingeri G. M. Barroso, Bol. Soc. Venez. Ci. Nat. 26: 151. 1965. TYPE: Costa Rica. Cartago: Turones (Pavones), Turrialba, 700 m, *Wendlinger s.n.* (RB, holotype).

Pendent epiphyte; stems ca. 20 cm long; cataphylls drying brown, weathering into coarse, persistent, longitudinal fibers; petioles terete, (5–)8–

30 cm long, 2–4 mm diam.; blades oblong, moderately thick, 32–80 cm long, 3–11 cm wide, round to truncate at base. Inflorescence spreading to pendent; peduncle 13–42 cm long, 3–7 mm diam.; spathe moderately thin, pale green tinged purplish, more or less oblong, 7–11 cm long, 8–13 mm wide; spadix pale green to white or grayish white, straight when young, becoming spiralled in age, 12–80 cm long, 3–5 mm diam. at base; berries reddish, more or less oblong or globose, ca. 5 mm long, flattened at apex with a central depression; seeds 1–4 (usually 4). See Croat (1983: 411) for a more complete description.

The species ranges from Costa Rica to Panama; Panamanian plants considered *A. wendlingeri* range from Veraguas in the west to Coclé, Panamá, and Colón Provinces on the Atlantic slope and along the Continental Divide in tropical wet and premontane rain forest at elevations of 350 to 900 m.

The species is in section *Porphyrochitonium* and is distinguished by coriaceous, oblong, glandular-punctate leaf blades, a very elongate, whitish, corkscrew-like spadix, and reddish berries. The blades are weakly velvety and obscurely punctate above and below.

It is most easily confused with *Anthurium pendens,* which occurs in similar habitats in Colón and Panamá. The latter, however, has oblanceolate blades that are broadest above the middle, acute at the base, and dry markedly blackened with the primary lateral veins departing the midrib at 10–20° angle. In contrast, *A. wendlingeri* has oblong blades that are not broadest above the middle, are rounded to truncate at the base, and dry green with the primary lateral veins departing the midrib at 30–40° angle. An additional difference between the two species is the inflorescence, which in *A. pendens* is short and erect with a straight pinkish spadix (turning greenish brown before anthesis).

COCLÉ: N of Cerro Pilón, *Croat 37517* (MO); vicinity El Valle, *Folsom 3108* (MO), *Luteyn 1238* (DUKE); road between Llano Grande & Coclecito, *Antonio 3595* (MO), *Croat 49221* (MO); La Mesa, *Croat 37329* (MO), *Luteyn & Kennedy 1667* (DUKE), *Nee & Dwyer 9168* (MO).

COLÓN: vicinity Agua Clara, *Correa et al. 1053* (MO), *Kennedy 2749* (MO); Santa Rita Ridge, *Croat 34295* (MO, RSA), *Gentry 6604* (MO).

PANAMÁ: Cerro Jefe, *Croat 35917* (MO), *Wilbur et al. 15564* (DUKE); El Llano-Cartí Road, *Croat 26033* (MO), *Mori & Kallunki 2854* (MO), *Nee et al. 8735* (MO).

VERAGUAS: Cerro Tute, *Croat 48914* (MO); valley of Río Dos Bocas, *Croat 27659* (MO); NW of Santa Fe, *Croat 49046* (MO).

Anthurium williamsii K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 11: 610. 1932. TYPE: Panama. Darién: near Cana, *Williams 817* (not seen).

Terrestrial; stems short; cataphylls drying brown, weathering into longitudinal fibers; petioles 23–61 cm long, 5–8 mm diam., subterete sometimes faintly 2–3-ribbed; blades narrowly ovate to broadly ovate, thin, more or less membranous, lobed at base, 26–48 cm long, 19.5–36 cm wide. Inflorescence erect; peduncle (16–)40–53 cm long, 4–5 mm diam.; spathe membranous, pale green, sometimes withering early, lanceolate, 7–12.5 cm long, 1.5–2.8 cm wide; spadix violet purple or green tinged violet purple, (7–)11–20 cm long, (6–)7–10 mm diam. at base; berries deep red-violet, obovoid; seeds 2. See Croat (1983: 414) for a more complete description.

Anthurium williamsii ranges from Costa Rica to Ecuador from near sea level to 1,800 m. In Panama it has been collected in premontane wet, tropical wet, and premontane rain forest.

The species is placed in section *Polyneurium* and can be recognized by its thin, veiny blade, its violet purple spadix, and by its deep red-violet berries. It is most easily confused with *Anthurium cuspidatum,* which has similarly thin leaves. See the discussion under that species for the differences between the two species.

BOCAS DEL TORO: Río Terebe between Quebrada Treglo & Puerto Palenque, *Kirkbride & Duke 539* (MO).

CHIRIQUÍ: Cerro Colorado, *Antonio 1428, 1429* (MO), *Croat 33382* (MO), *Mori & Dressler 7847* (MO); SE of Fortuna Dam site, *Correa et al. 2085* (MO), *Croat 48698* (FTG, MO), *49934, 50083* (MO); vicinity Gualaca, *Antonio 5174* (MO); above San Félix, *Croat 33144* (MO).

COCLÉ: Alto Calvario, *Croat 49194* (MO), *Folsom 3406* (MO); Cerro Pilón, *Croat 37518* (MO), *Liesner 736* (MO), *Porter et al. 4372* (MO); vicinity El Copé, *Antonio 1151, 1188* (MO), *Croat 44722* (MO), *Folsom 3236, 3271* (MO), *Folsom et al. 5675* (MO), *Folsom & Collins 6454, 6513* (MO), *Hammel 800, 1022* (MO); above El Potroso, *Sytsma 1775* (MO), *Sytsma & Andersson 4559* (K, MO); vicinity El Valle, *Gentry & Dwyer 3620* (F, MO), *Gentry 6866* (MO), *Luteyn 1151* (DUKE), *Luteyn & Kennedy 1629* (DUKE); vicinity La Mesa, *Croat 13333, 22955, 25325, 25338* (MO), *37345* (MO, PMA, US), *Liesner 748* (MO), *Luteyn 4090* (DUKE), *Mori et al. 1905* (MO), *Wilbur et al. 15661* (DUKE, MICH, MO); past Llano Grande on road to Cascajal, *Sytsma 3971* (MO).

DARIÉN: Cerro Pirre, *Duke & Elias 13821* (K, MO), *Gentry & Clewell 7031* (MO).

PANAMÁ: top of Cerro Pelado, *Antonio 1089* (MO).

VERAGUAS: Cerro Tute, *Witherspoon & Witherspoon 8829* (MO); Escuela Agricola Alto Piedra on road to Calovébora, *Croat 33955* (MO, PMA); vicinity Escuela Agricola Alto Piedra along Río Dos Bocas, *Mori & Kallunki 3096* (AAU, MO); valley of Río Dos Bocas, *Croat 27384* (MO, PMA), *27426, 49011, 49020* (MO), *27493* (MO, NY, PMA, RSA); above Río Primero Brazo, *Croat 23220A* (MO); vicinity Santa Fe, *Croat 23180, 25476* (MO), *Gentry 2989* (MO), *Hammel 4679* (MO), *Liesner 1027* (MO), *Mori & Kallunki 4734* (AAU, MO), *6103, 6121, 6712* (MO).

Species Excluded or Dubious

Anthurium agnatum Schott. Part of the material of *A. salviniae* was attributed to *A. agnatum* by Standley (1944). *Anthurium agnatum* was described from an Oersted collection from Nicaragua but all that remains to be investigated is a drawing of two leaves. It is not possible to be certain of the identification and it could be one of three species in section *Pachyneurium*, namely *A. cubense, A. upalaense* Croat & Baker or *A. schlechtendalii* Kunth. The name should be considered a nomen dubium.

Anthurium crassinervium (Jacq.) Schott. This species is restricted to the coastal cordillera of northern Venezuela. Specimens attributed to this species in the "Flora of Panama" were either *A. salviniae* or *A. purpureospathum* (those from Bocas del Toro Province).

Anthurium denudatum Engl. This species is restricted to Colombia at elevations mostly above 1,800 m. The specimens cited and illustrated in the "Flora of Panama" are *A. brownii.*

Anthurium littorale Engl. This name is a synonym of *A. durandii* Engl., restricted thus far to southern Costa Rica. Material cited from Panama as *A. littorale* in the "Flora of Barro Colorado Island" (Croat, 1978) is *A. paludosum.*

Anthurium maximum (Desf.) Engl. This species is believed to be restricted to Colombia. The only specimen cited in the "Flora of Panama" (*Pittier 2679*) is *A. salviniae.*

Anthurium schlechtendalii Kunth. This species ranges from Mexico to Nicaragua. The specimens cited in the "Flora of Panama" as this species are all *A. salviniae.*

Anthurium tetragonum Hook. ex Schott. This name is a synonym of *A. schlechtendalii* (see above). Specimens cited as *A. tetragonum* by Standley (1944) and by Croat (1978) are *A. salviniae.*

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